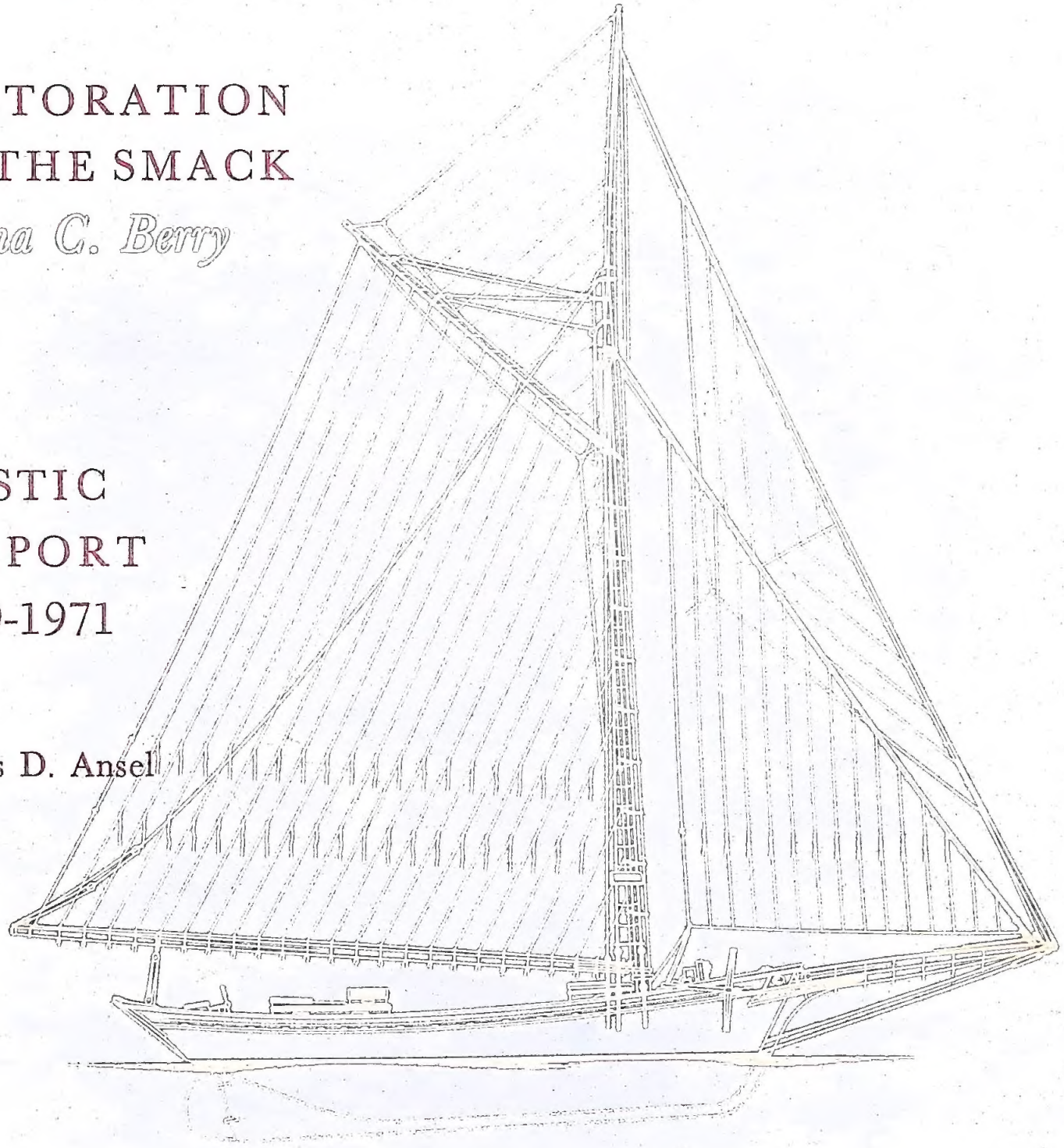
RESTORATION OF THE SMACK *Emma C. Berry* AT MYSTIC SEAPORT 1969-1971

Willits D. Ansel



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written and illustrated by

Willits D. Ansel

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CONTENTS

Foreword	Maynard Bray	1
Acknowledgements		3
Introduction		5
I	Plans and Preparations for Restoration	11
II	Reconstruction Topside	16
III	Reframing	22
IV	Floor Knees	29
V	Mast Step and Keelson	36
VI	Sheer Clamps and Ceiling	40
VII	Spars	48
VIII	Making the Hull Tight	58
IX	Wet Well	63
X	Painting and Decoration	71
XI	Standing and Running Rigging	75
XII	Launching and Completion	84
Appendix		
Scantlings, Spar Dimensions, Rigging Sizes		90
Glossary of Terms		92
Men Who Worked on the Restoration		94
Bibliography		94
Lines, Sail Plan, Deck Plan,		foldouts

FOREWORD

"RESTORATION" has a variety of interpretations, but here it means a deliberate change in a vessel's appearance to that of a specific time in her career. Our objective for the *Berry* was to represent the period between her launching in 1866 and her 1886 conversion to a schooner, for it was during these early years that she was most closely connected with the town of Noank, site of the Palmer yard which built her and only three miles from her present berth at Mystic Seaport.

Substantially correct outward appearance was assured by several old photographs of similar craft. Equally valid information about her basic hull construction, in spite of our research efforts, could not be found, so here good shipbuilding practice prevailed. Hoping in the future to learn exactly how it was done on this type of vessel, we held off installing the below decks accommodations.

In a lifetime of more than a century, *Emma C. Berry* had been altered and repaired many times and on each occasion lost some of her original timber. Thus she came to us having only the keel, aft deadwood,

traces of frames and possibly the stem and sternpost with which she was built; all else, including the hull planking and decking, was from a later time. A study of paint lines, wear marks, fastening holes, etc., therefore shed little light on how she was initially laid out and constructed. With so little to go on, was this project worthwhile? We believe it was or rather is, for it cannot be called complete until missing information is somehow tracked down and incorporated into the vessel herself. This fact alone, that the *Berry* is a catalyst encouraging research for a specific end use, is important. She also is a means by which wooden shipbuilding techniques and skills are kept alive and recorded, as Will Ansel has done in this book. And from a schooner yacht in desperate need of extensive repair we have recreated, outwardly, a Noank well smack and a strong and long-lasting vessel throughout. That the *Berry* is important historically cannot be argued, neither can her relevance to this museum. She outlived all her once numerous sisters and today singularly represents an important fishing activity once carried on only minutes away from here.

As we seek to understand the past, so our descendants will want to know what we did, how and why. Records by those who have actually done the things they describe are most valuable, yet it is rare for a doer and a writer to be one and the same person, particularly when it relates to shipbuilding. I think it is significant then that herein is not only a narrative which records in detail the operations and rationale used in restoration of the *Emma C. Berry,* but is also a first-hand account written and illustrated by one who did a substantial part of the actual work.

Maynard E. Bray
Shipyard Supervisor,
Mystic Seaport

ACKNOWLEDGEMENTS

We wish to acknowledge and thank those who furnished much needed information for this restoration, particularly Milton Beal, a former owner, who supplied information on the wet well, deck arrangement and general history; H. I. Chapelle who helped establish the wet well and ceiling details, and also furnished plans for the *Grampus,* a Noank-built fisheries research vessel; John F. Leavitt who advised on the color scheme and rigging detail and Robert Palmer, Captains A. K. Lane and John Wilbur of Noank for answering various questions on local history and boatbuilding practice.

1860s carried a large, gaff mainsail and a single jib for working sails. Gaff topsails and jib topsails were set in light weather. The sloops were known along the coast as far south as Key West and the Gulf Coast where many of them engaged in coasting and fishing. A number of copies of the local sloops were built at Key West in later years.

The earlier sloops had less sheer and fuller bows, as was common in craft of all classes. Later, with the clipper influence, the entrance became hollow and the greatest beam was shifted aft. The sloop rig gave way after the middle of the nineteenth century to the schooner rig, and the *Berry* herself was later converted to a schooner. Noank vessels were handsome as well as able: the raking stem faired into the clipper bow, the raked transom and the sheer of the later models gave a fine appearance. The *Berry* was a good representative of her type: 47′ overall, 14′ beam and 6′ draft.

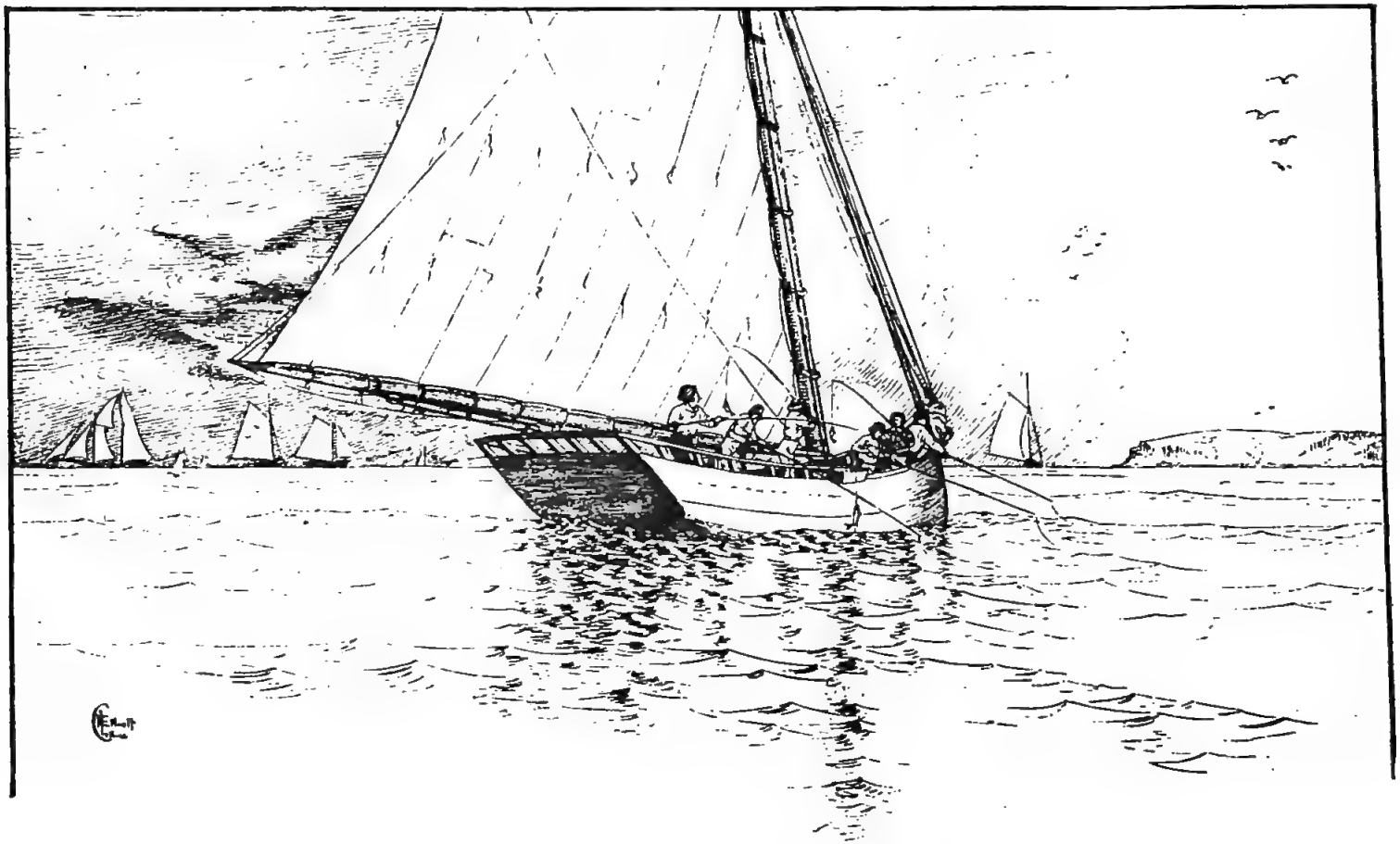
Mackerel smacks from Noank and New London in the decades after the Civil War caught fish by hook and line or seining. The well smacks could keep their catch alive; sometimes they carried the fish directly to the market in New York. Generally it was carried to New London and kept in floating tanks or cars—for weeks and even months; later it was distributed by rail to markets.

Noank was an active center for both shipbuilding and fishing. A Fisheries Commission Report of the 1880s describes the town:

> The village or town of Noank is a small but very enterprising place. There is owned here a fleet of fifty-one vessels. . . . These vessels have crews aggregating 221 men.

The mackerel fishing changed techniques from "drailing"—or fishing with poles while trolling under sail, to jigging—or fishing with hand lines, to, finally, seining. The *Berry* began her career during the jigging phase. She fished between Montauk and Cape Cod where, according to the Fisheries reports of the period, small quantities of extraordinarily fine mackerel were caught from the spring to the fall.

The hook-and-line vessels were somewhat specialized for the task. Decks were kept clear for the fishermen who worked the starboard side. Cleats for the lines were fastened inside the rail and bait boards with precut strips of pork rind or mackerel belly were



Reproduction of plate showing mackerel fishing. The Fisheries and Fishery Industries of the United States, *Sect. V. 1887.*

secured to the top of the rail. Snapper cleats held the lines in place along the sides. On the port side the bait mill ground menhaden or clams for chum, which was thrown overboard to attract the fish. The fishermen used a jig, a hook with a tear-shaped lead weight cast to the shank, with each man handling seven to twelve lines six to eight fathoms in length. The jigs were baited with the strips of rind or mackerel; the boat hove-to and the chum was thrown over. Test lines were put down, and when the fish began biting, the action was fast. In a single day one man might catch ten to fifteen barrels of fish with 150 to 200 fish to a barrel. As described in Goode's Fisheries Commission Report of the 1880s:

> The confusion and excitement is increased by the frequent snarling of the lines. . . . Little is said while the fishing is going on; the men lean far over the rail in strange attitudes of expectancy with one or two lines in each hand, the hands moving up and down and constantly hauling in and throwing out one of the lines.

Mackerel fishing was seasonal. It was common for vessels to register as mackerel fishermen and actually be employed in other

fisheries and other work such as coasting or carrying, as opportunities presented themselves. The lobster industry was expanding rapidly and it is not unlikely that the *Berry* lobstered or carried fish or lobsters to market. It is known that in Maine later in her career she was employed as a lobster smack.

In the 1880s Noank lobstermen caught about half the lobsters taken in Connecticut. They lobstered all year and were noted for their hardihood and enterprise. Most of the lobstering was done in smaller sloops which worked the grounds in Fishers Island Sound and out in Block Island Sound from Montauk to Noman's Land. Larger smacks such as the *Berry* covered these grounds and as far out as Nantucket. As New York became a major market, the fishery expanded. Testimony taken at Noank and published in 1887 stated that the number of pots had increased tenfold in the previous decade. Though the catch per man had decreased from 200 pounds to 50 pounds a day, the top earners in the small sloops were making between $500 to $600 a season. The men in the smacks might make $1,000. The catch was marketed in New London, Norwich or New York, and shipped to the latter market in well smacks or in barrels of ice aboard steamers.

Thirteen smacks between eight and twenty-seven tons, ten sloops and three schooners sailed from Noank. A smack the *Berry*'s size might carry three or four men while lobstering. A small smack of fourteen tons in the carrying business could hold some 2,000 lobsters, averaging one and one-half pounds, in her well. These she might carry to market in New York, losing from between 1 and 6 percent on the way. Losses were higher in the summer because the lobsters were more active and casualties resulted from fighting.

The *Berry* fished local waters for almost thirty years—some of the time as a fishcarrier rather than a fisherman—and was registered first in Stonington and then in New London. She was rerigged as a schooner to divide the rig for easier handling in the 1880s. Then in 1894 she was sold to an owner in Maine, where she was to remain for many years. Here she worked as a wet well lobster smack and bait carrier, but as she gradually deteriorated, her employment became more humble. Once she was sold at public auction in Portland. Finally, in 1924 she seemed worn out, "fished out," and her owner abandoned her on the mud flats of Beals Island, Maine where she lay, filling and draining with the tide.

Many schooners ended thus, but the

Berry was to be saved two years later by a new owner who afterward said he was attracted by her lines. He pulled her off the mud and patched her. Some new frames of birch were put in and she was replanked with cedar in the waist in the area of the well, which was removed. Now she began a new career as a coaster, hauling coal, salt and dried fish along the coast of Maine. By 1931, with coastal trade suffering from the Depression, the *Berry* was left again in a state of neglect and disrepair. She had had no freight for some time and was apparently doomed, when she was again saved by her fine, handsome lines.

Her new owner, Slade Dale, bought her for use primarily as a yacht. He wrote later that he agreed to buy her when he first stepped aboard, which happened to be in the middle of the night, and that he paid the first price asked, much to the surprise of the Maine owner. In the morning he found that his new boat was in immediate danger of either sinking or burning as she leaked without pause and the two ancient, over-heated engines that filled the after cabin were like bombs ready to explode. He did not mind, however, and in the years that he had her, spent a good deal on the upkeep and repair of the old vessel. The *Berry* sailed at times as a yacht and at times as a freighter on the coast of New Jersey, in the Chesapeake and as far south as the Carolinas. She was replanked in Norfolk and had new masts put in her in Oxford, Maryland: all in all, shipwrights in four or five states have worked on her over the hundred years of her existence. In June, 1969 Mr. Dale gave her to The Marine Historical Association—the last of her type, both as a Noank sloop and as a mackerel hook-and-line sailing vessel.

Between 1820 and 1870, six hundred to nine hundred vessels each year were in the mackerel fisheries. Thoreau described the mackerel fishermen off Cape Cod in the 1850s:

> . . . the mackerel fleet continued to pour around the Cape to the north of us, ten or fifteen miles distant, in countless numbers, schooner after schooner, till they made a city on the water. They were so thick that many appeared to be foul of one another; now all standing on this tack, now on that.

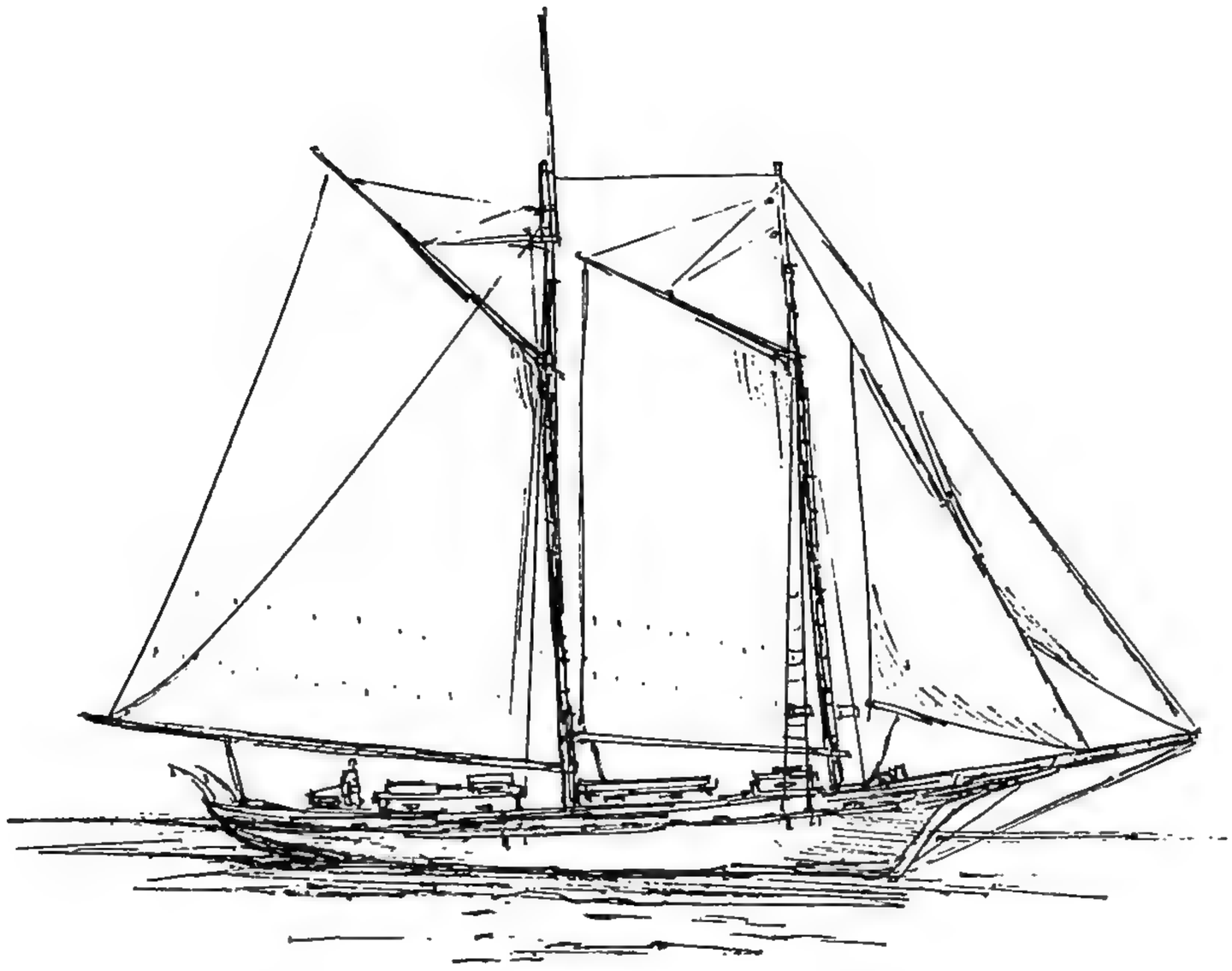
The *Berry* is the last of all those hundreds.

Chapter I

PLANS AND PREPARATIONS FOR RESTORATION

THE *Emma C. Berry* was presented to the museum in June, 1969 by Mr. Dale to be a part of the collection of New England sailing craft. The ship carpenters, riggers, caulkers and painters at the Seaport have restored her to her original condition and rig, a Noank well smack of the 1860s. Authenticity and preservation were the aims of the work.

Reports conflicted on the condition of the vessel when she was acquired. An earlier survey had stressed the reconstruction work of the 1930s when she was replanked with white cedar, the decks rebuilt, and some new frames installed. She was, in this view, substantially a new vessel in 1935. Other reports described those repairs and earlier ones as patch-up work—the vessel had been "retopped"—rotten timber had not been removed. The reinforcing of deck frame, heavy bulkheads, sister frames, new stem apron, and new timber in the stern held the *Berry* together and preserved her graceful lines. She was, in the words of another later report, "an old, tired vessel and really fit only for venerable retirement in its present condition."



The Emma C. Berry *rigged as a schooner. Davits and deck house amidships are not authentic for a Noank sloop. These were removed and she was rerigged as a sloop during reconstruction.*

The trip from New Jersey that brought her to the Seaport showed some of her weaknesses. She came partly under sail and partly under tow and the strains of the voyage caused serious leaking. The first decision was to caulk her immediately, and this was done. The lead patches over the butts were removed and the Dismal Swamp white cedar planking examined and judged sound. She was then returned to the Seaport and basic plans were made for the work of restoration.

It was clear that to restore and preserve

the *Berry* would be a major undertaking. The decision was made to pull the masts, haul her at the Seaport, build a temporary shelter over her, remove all her rotten timber and replace frames and floors as necessary. Other decisions would be made as the work progressed and as research revealed detailed information about vessels of her type and period.

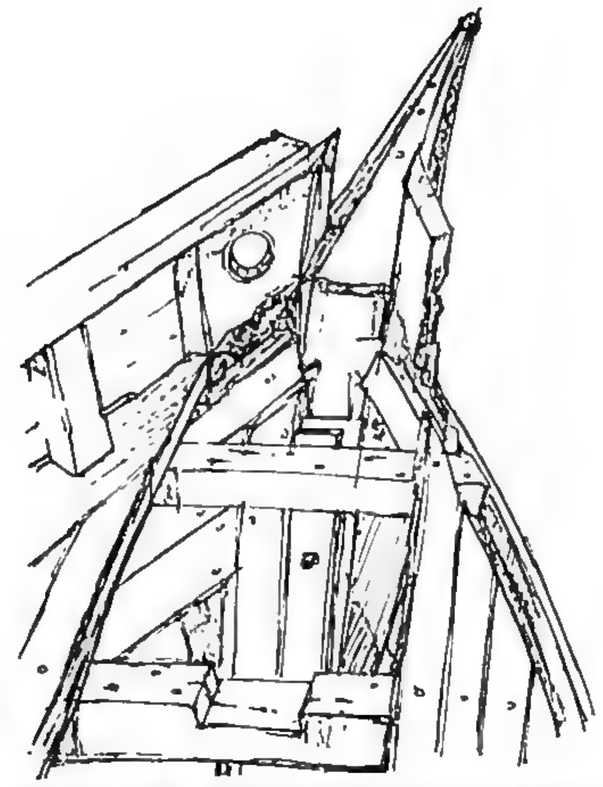
It was realized that the materials used in restoration would not always be the same as were used in the original construction. The needs of preservation sometimes were in conflict with completely authentic restoration, but cost was not as much a factor as it was when the vessel was built as a business venture. The best materials available went into her. Bronze fastenings were used rather than wooden treenails or galvanized ship spikes. In some cases woods that were more rot-resistant, such as teak for the stanchions, were substituted. Alaskan cedar, now recognized as a superior shipbuilding material, was used for the sheer strakes: this wood was unknown when the *Berry* was built. On the other hand, the original builders may have had a better choice of some woods, such as white oak with sweep to the grain and clear of knots, or clear pine, than did her restorers.

Information that aided the work on the *Berry* was to come from various sources. Former owners and people who had known the boat were consulted. Milton Beal of Jonesport, Maine, owner in the 1920s, provided information on the wet well, which he had removed, and the deck arrangement. He also had interesting stories about her career as a coaster in Maine. Howard I. Chapelle, naval historian and architect and retired Senior Historian for Museum History and Technology at the Smithsonian Institution, was consulted concerning sheer clamps, ceiling, well and other details. Old photographs of Noank sloops were scaled for spar dimensions and rigging plans. The G. W. Blunt White Library at the Seaport was a source of information. Finally, the knowledge of wooden ship construction of the ship carpenters on the Seaport's staff was applied to the restoration. The shipwright in charge was Arnold Crossman: he brought to the job long years of experience, including twelve at the Seaport.

In accordance with the plan, the *Berry* was readied for hauling. Masts and spars were removed. Rotted timber, such as bulwarks, was torn off. As fittings and timbers came off, they were tagged, and notes and sketches were made of locations and construction details. This work was reproduced or restored as faithfully as possible later. The ballast was removed and the *Berry* was hauled on the Seaport's railway. She was then skidded 40′ to the side with truck-mounted winches and blocked and shored in place. Two main sets of shores held her level athwartships. The blocks put the keel at an angle that dropped the stern 1″ for every three feet of length.

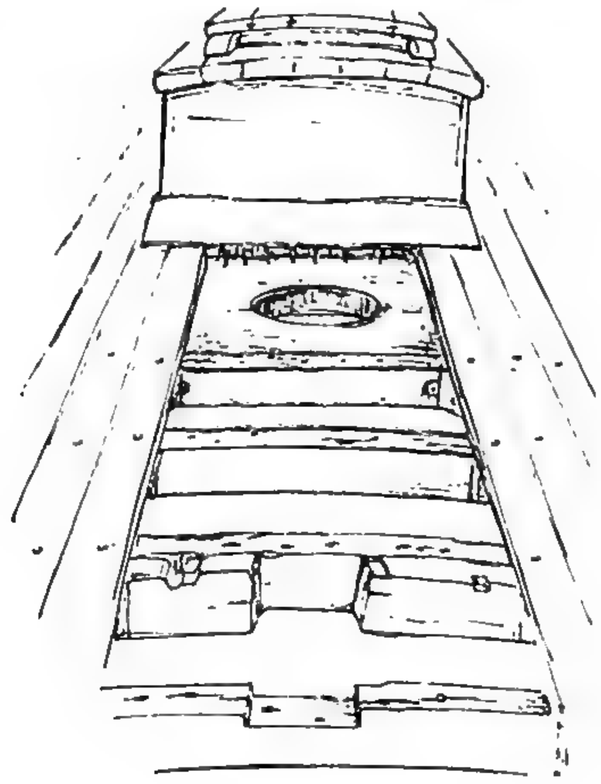
The shed that covered the *Berry* gave protection from the elements to both the vessel and the men working on her and, under cover, restoration continued year-round. A danger in placing any craft in a building heated in winter and hot in summer is drying out: the methods of heating and ventilating were such, however, that there was no serious drying in the course of two winters and a summer of work.

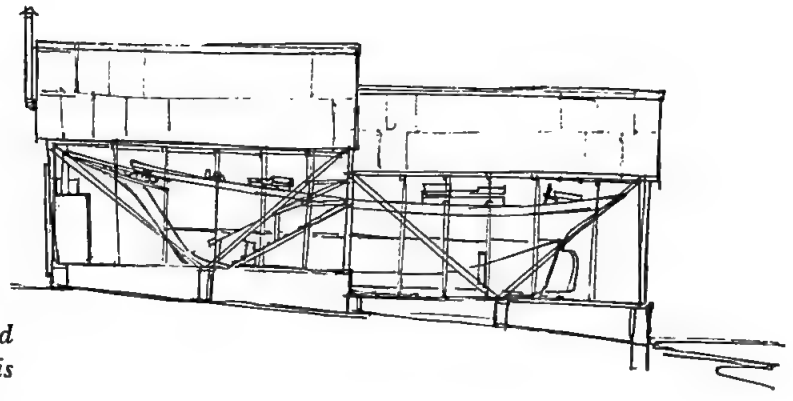
The shed was of wood, the roof covered



King planks and bulwarks taken off to find the extent of rot. Knightheads, deck beams and tops of frames were found to be rotted.

Deck beams and partners after removal of king plank





Berry *in her temporary shed. The roof is corrugated aluminum; the walls are polyethylene sheets. The shed is equipped with furnace and electric power.*

with corrugated aluminum sheets, the sides with polyethylene plastic and plywood under the eves. The building, standing on concrete pilings, was 56′ long and 23′ wide. It was built to give 5½′ of clearance on the port side, where a ramp was built to deck level, and 2′ on the starboard side. Aft, the end of the shed was 3′ from the counter and 1½′ from the billet head forward.

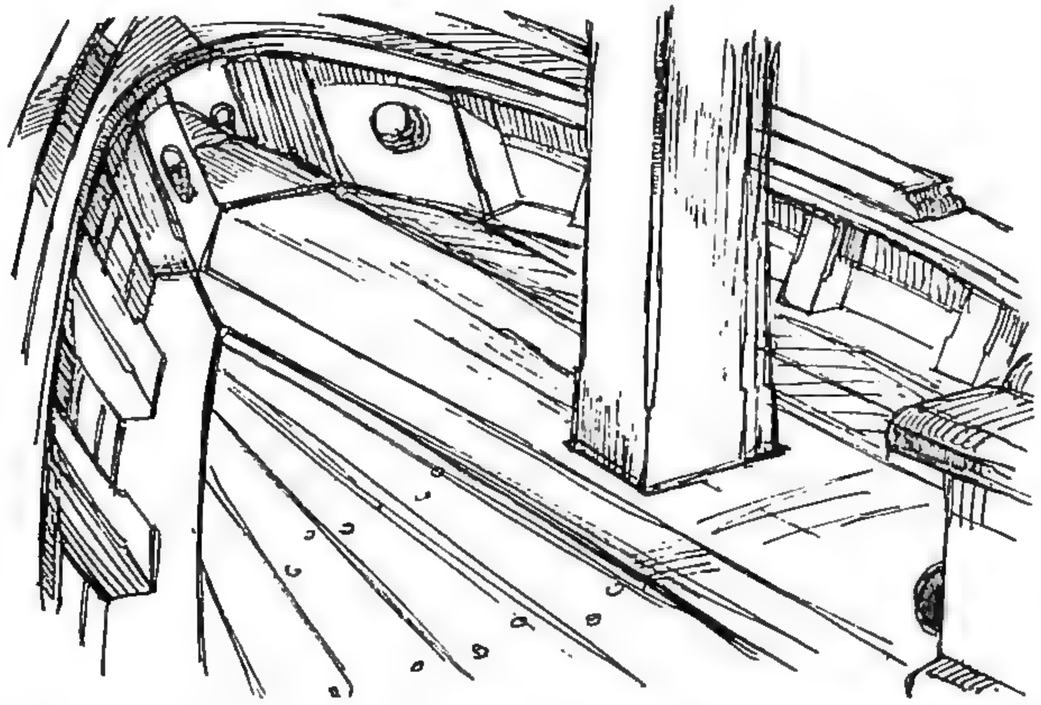
Heat was provided by an oil-burning, hot air furnace. This gave immediate heat through rigid sheet metal ducts attached to flexible tubing leading below. The furnace was shut off when the men were not working, a practice that reduced drying. In summer, the plastic under the eves was opened and a fan rigged to keep air moving under the metal roof.

The work took two years, far longer than the six months taken to build the boat originally. New construction is often faster and cheaper than restoration. The yard and shipwrights that built the *Berry* over a century ago had made many like her. Their equipment and skills were specialized for the task of building Noank sloops as efficiently as possible and they were masters of their craft. Often the men restoring the vessel had to rediscover what had been common knowledge to the original builders. The Seaport was not sparing in its pains to make the *Berry*'s restoration authentic and to bring her to a condition which would insure preservation for many more years.

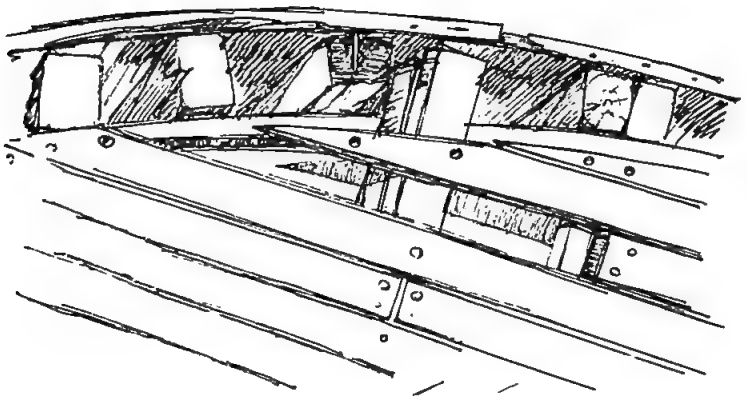
Chapter II

RECONSTRUCTION TOPSIDE

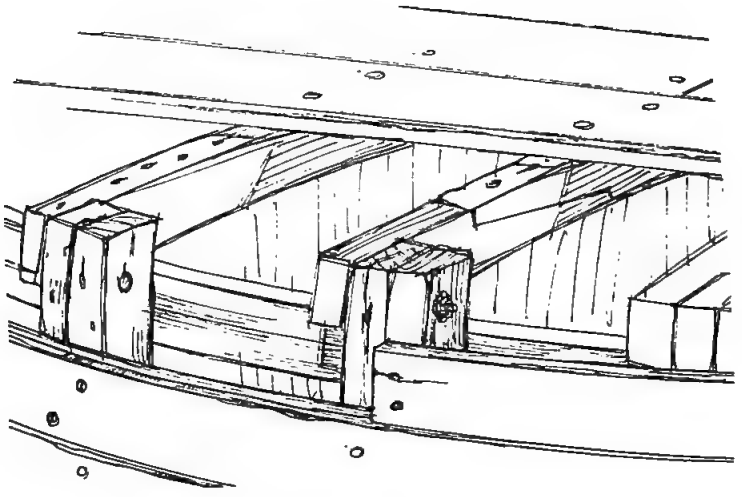
EARLIER surveys had reported rot about the deck of the *Berry*: after her arrival at Mystic Seaport, she was examined more thoroughly and considerable rot was found where knightheads, stanchions, bitts and masts pierced the deck. These structures are normally subject to strains: fresh water standing on deck seeps in the seams and causes the rot. It attacks the timbers themselves, the planking of the deck, and deck beams and partners beneath. The *Berry*'s sheer strake, covering boards, stanchions, bulwarks, bitts and king plank



Bow showing rebuilt bulwarks and knightheads. Bowsprit passes through knightheads and mortices into the pawl post.



Covering boards removed showing rotted frame tops



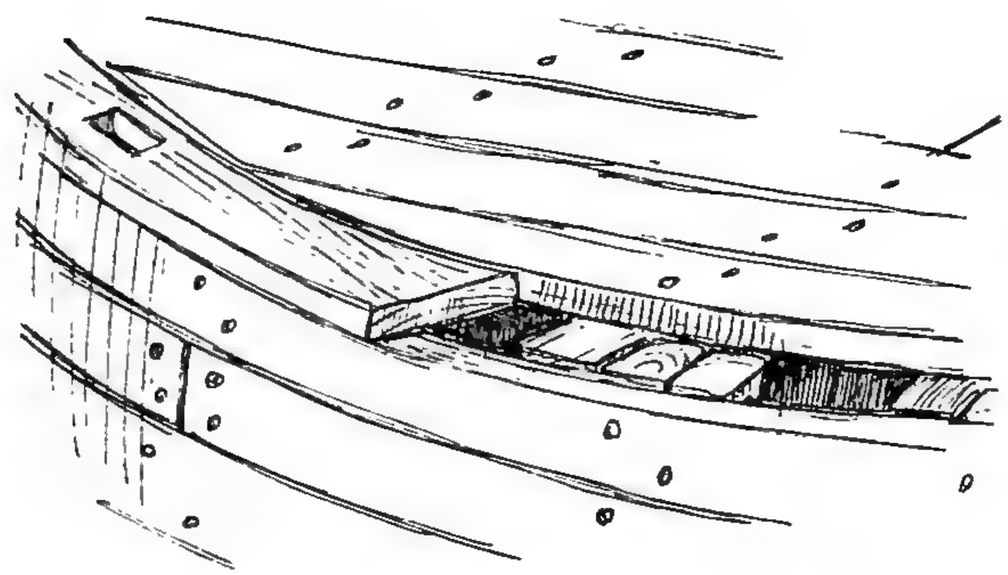
Sheer strakes were removed and replaced. Deck beams are through-bolted to frames where possible. New ends were spliced to a number of rotted beams.

were all rebuilt. Parts of the deck frame were also strengthened by rebuilding partners and either replacing or splicing new timber to deck beams.

Rotted covering boards and the sheer strake were removed before the *Berry* was hauled. Ends of rotted deck beams were cut off and new ends scarfed on, the joints glued with epoxy and bolted. New sheer strakes of Alaskan cedar were then fastened. The 2″-thick covering boards, sawn to the curve of the hull, were fastened to the deck beams with bronze screws. Stopwaters of cedar crossed the seams between the pieces of the covering boards.

Stopwaters must fit tightly to be effective, particularly above the waterline where they may dry out. The bit that is used to bore across the seam is also used to bore a hole through a piece of oak, which serves as a die. The cedar stopwater, after having been rounded with a plane, is then driven through the oak, which smoothes and rounds it rather as a wire is drawn through a die. The stopwater is then driven in place across the seam.

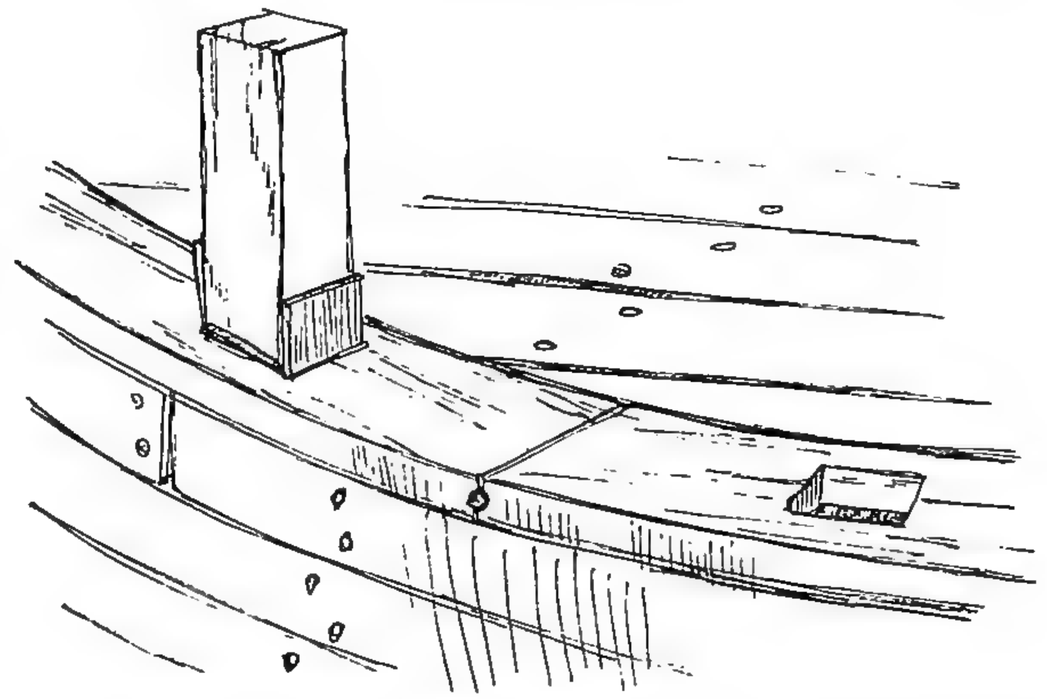
The knightheads and stanchions pass



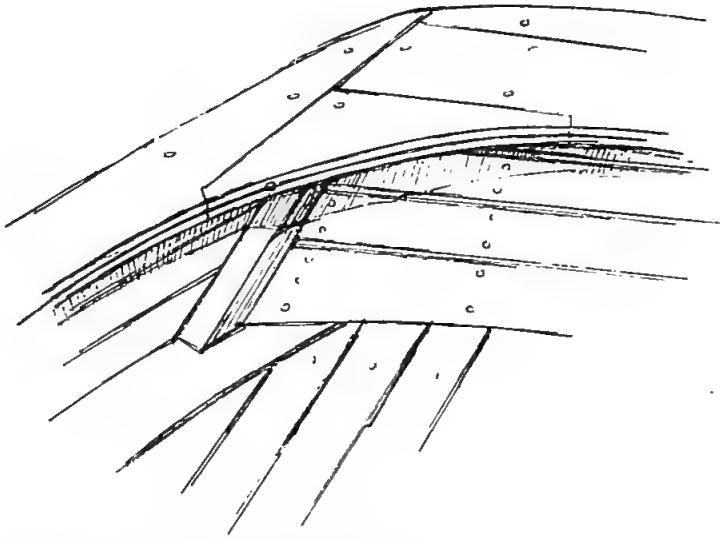
New covering boards sawn to follow the curve of the hull

through the covering boards. Under the deck, the knightheads lie against the planking and stem or apron and project down 30″. The seams where they pass through the covering boards are caulked and sealed with pitch. The timbers are 3¼″; two 10″ planks together make up the width. Knightheads may be put to considerable strain as the hawse pipes are set in them and the bowsprit passes between them.

The stanchions, seventeen to a side, were all removed and replaced. They are teak, 3″ x 4″, where they pierce the covering boards. At the cap, they are tapered to a thickness of 2¾″. The stanchions are placed between frames approximately 30″ apart. In this vessel they are not fastened to the frames: if they should need replacement, they may be removed without disturbing the frames. Two screws, 3″ No. 16, driven through from the outside of the planking fasten each plank. The stanchions extend down inside 20″, and where they pass through the covering boards they are pined—that is, thin wedges of pine or cedar are driven in around the stanchion, making a tight seam. There is no caulking or pitch in the seam that is



Stanchions are pined with wedges of soft wood to prevent leaking. Stopwaters cross seams where covering boards butt.



Rail cap on the starboard quarter

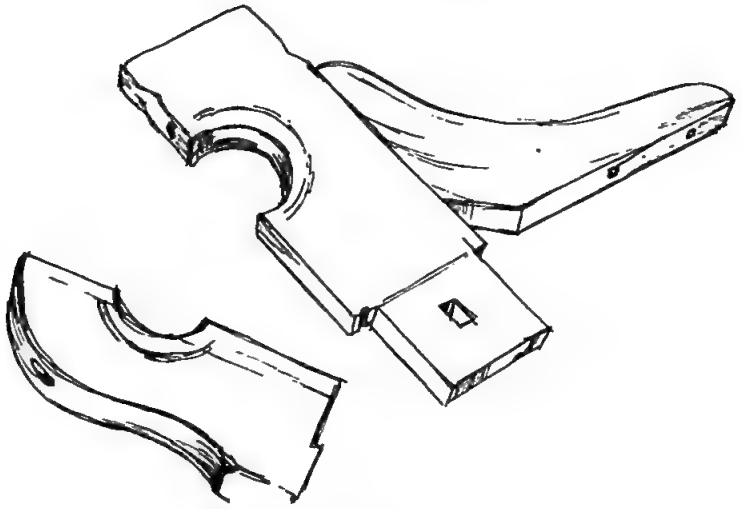
pined. Below, the stanchions are treated with red lead.

· The stanchions support the cedar bulwarks and yellow pine rail cap. Three planks, 3½" wide on edge, make the bulwark. The lowest is 1¼" thick, while the upper two are 1" thick. Edges both inside and out are given a ¼" bead. The bottom piece was cut for scuppers on the high side of the stanchions in the waist of the vessel and bronze screws with heads bunged fastened the planks to the stanchions.

The rail cap—1½" thick and 5¼" wide—was sawn to shape with beaded edges inside and out. The cap was fastened with screws to the tops of the stanchions and to the top plank of the bulwark. An additional buffalo rail, protected with bands of iron on top, adds to the sheer forward. This rail protects the bulwarks when securing the anchors. It is 3" high at the forward end, where it passes over the bowsprit and tapers to 2" at the after end. The rail cap across the transom is two planks in width and sawn to a curve. Knees join it with caps on the sides.

The rotted king plank and the deck beams at the pawl post were replaced and new sections of deck beams were scarfed, bolted and glued with epoxy. Beams and partners around the mast were also strengthened. The new king plank, made of two pieces of yellow pine, 2" thick, was then laid; and a hole for the mast 13½" in diameter was cut through it. The new wood under the deck was painted with red lead as a preservative.

The pawl post or bitt has the bowsprit morticed into the forward side and the windlass pawl mounted on the after side. The longleaf yellow pine post is 5" x 8" at the deck: below it tapers to 2¾" x 5". The post rests on the stem knee and is bolted to a

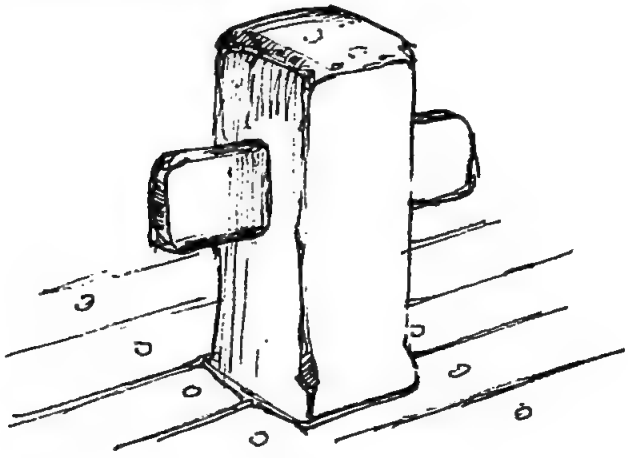


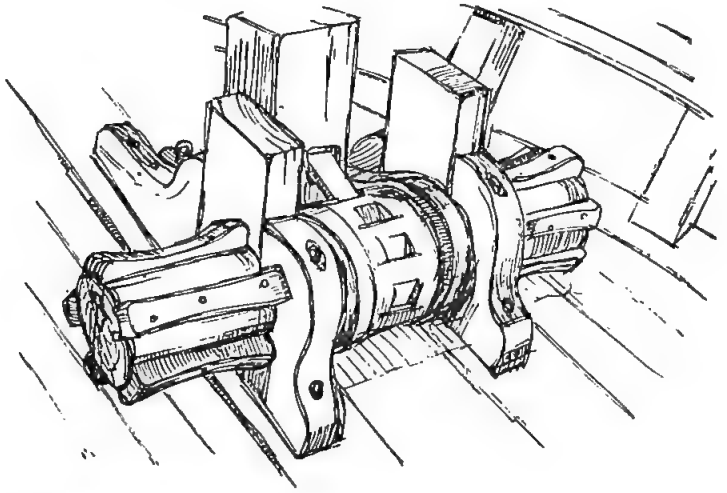
Windlass bitts before assembling. Bitts are morticed into the king plank. Key holds the tennon beneath the deck.

floor timber with a ½" bronze bolt. The post is also bolted against a deck beam with a bolt of the same size and the seam where the bitt passes through the king plank is caulked. The mortice on the forward side cut for the bowsprit is raised ½" off the deck to prevent water from collecting. The whole post was treated with preservative before painting and the top of the bitt capped with sheet lead set in white lead hammered to fit over the edges of the top and secured with copper tacks. This capping keeps water from entering the end grain. The windlass bitts and mooring bitts aft were similarly capped.

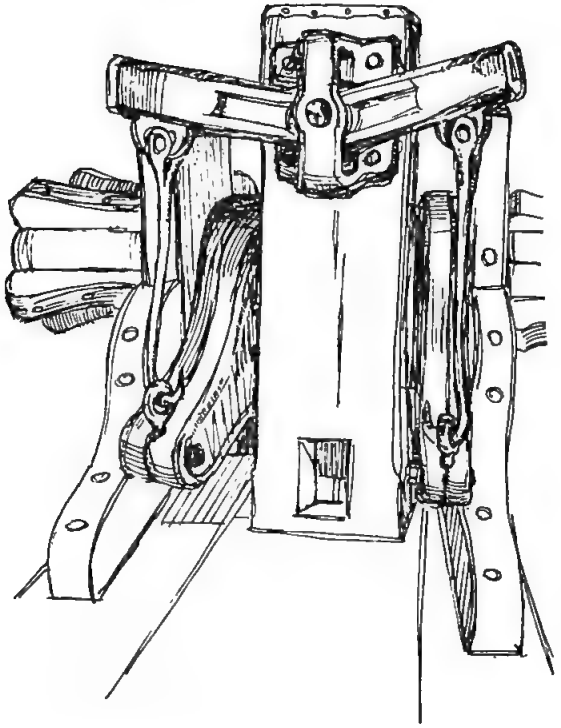
The horizontal windlass drum is supported by two bitts morticed into the king plank immediately abaft the pawl post.

After mooring bitt with lead cap to prevent water from entering the end grain





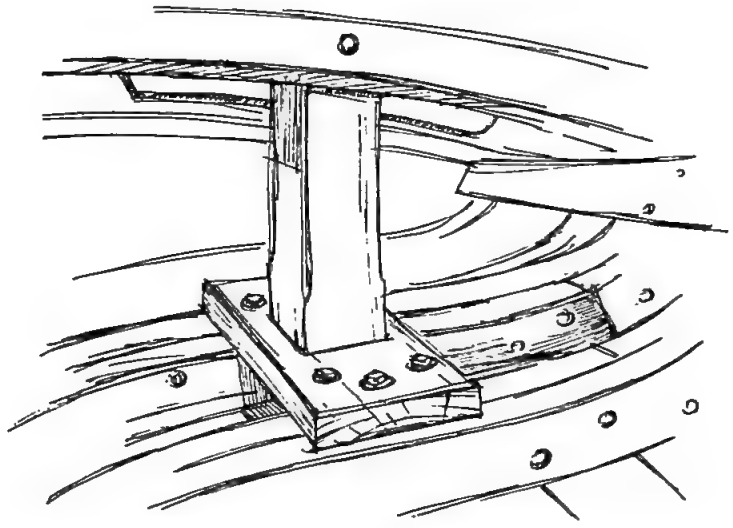
Windlass viewed from aft



Windlass mechanism from forward

These bitts are yellow pine, 2¼″ thick; each stands 25″ above the deck and is made up of three pieces held together with lag screws and through bolts of ⅜″ bronze rod. The forewardmost piece of the three is a hackmatack knee, placed to take the thrust as the anchor is raised. Two slots are cut through the king plank to receive the tennons of the center piece of the bitt. Below, yellow pine pins key the tennons. The other (aftermost) piece of the mounting is bolted and secured with lag screws to the deck beam beneath and the king plank. All joints and seams were payed with white lead.

The bitts aft are 5″ x 5″ teak and project 14½″ above the deck. Oak pins pass through them at the top to prevent lines from slipping off. Under the deck, the bitts lie against a deck beam on the forward side. On the after side, a short hanging beam is fastened to the deck. A ½″ bolt passes through beams and bitt: the bottom of the bitt is morticed into a step which lies across two frames. The oak step, 1½″ thick, is secured down with lag screws.



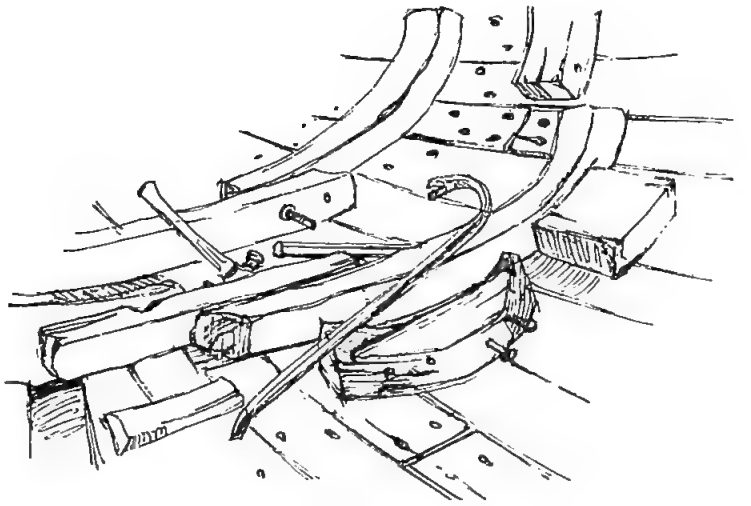
The step of the mooring bitt fastened to frames below

Chapter III

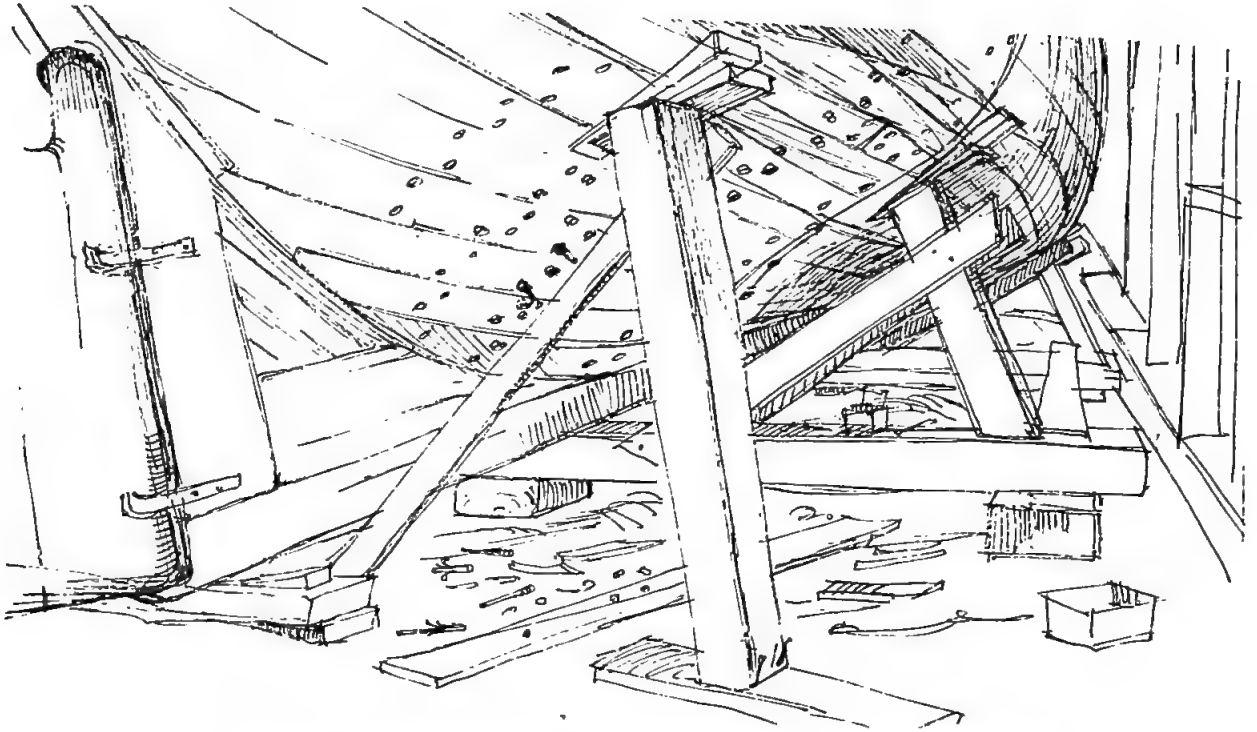
REFRAMING

THE *Berry* was virtually reframed during restoration. The need for this work became clear as the ceiling was removed, the bilges cleaned and the frames uncovered. A few frames, mainly in the bow and stern, were left in the boat, but of a total of twenty-five, nineteen new ones were built. This construction presented some problems in designing and fitting not found in new construction.

The frames that were in the boat before restoration appeared to vary in age from originals bored for treenails to frames placed



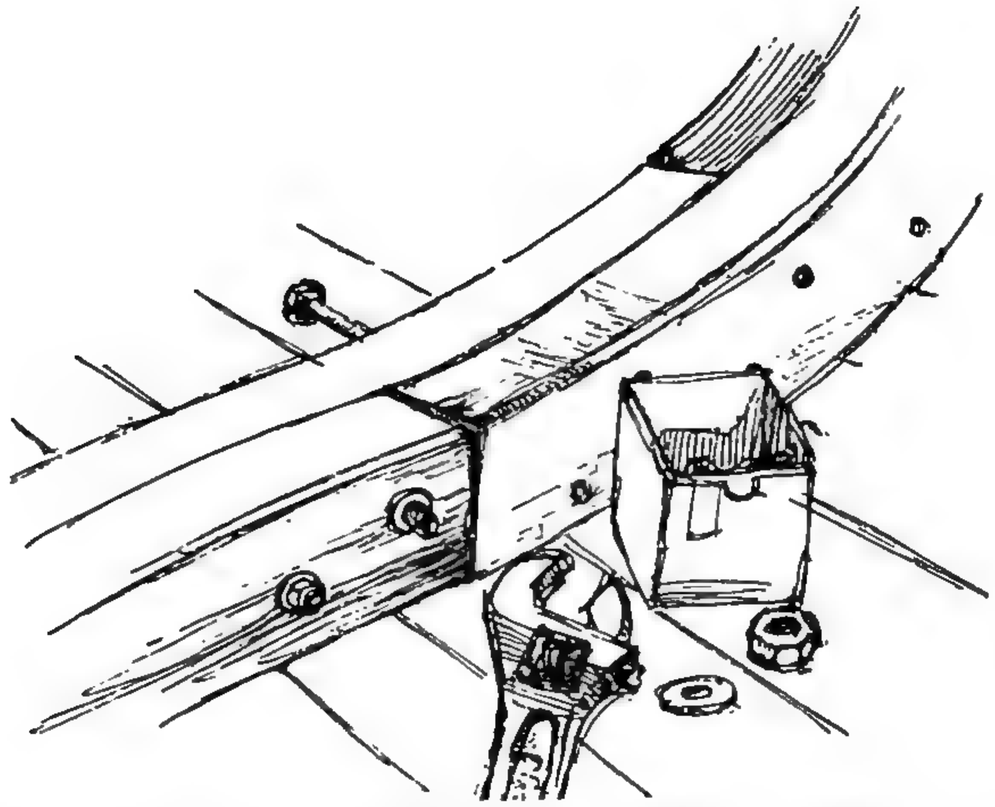
Tearing out the old frames



Shoring to prevent loss of shape as the old frames are removed

in her during reconstruction in the 1920s and 1930s. In most cases, whether new or old, the frames had deteriorated next to the planking and the fastenings were weak. Most frames were white oak, a few with the bark still on top. Some birch was found, which probably went into the *Berry* during her rebuilding in Maine. The fastenings were ship spikes, 4″ long, some completely rusted away where plank and frame met. Galvanized bolts fastened the frames that were doubled. The fit of frames to planking varied from tight to gaping cracks: some pieces were unattached chunks, spiked to the planks and not part of a complete frame. As the work progressed, it was necessary to remove almost all of the frames because they were unsound or because their position put them in the way of new construction.

The old frames were removed by cutting them up, splitting them and prying them loose. This work was done cautiously, a few



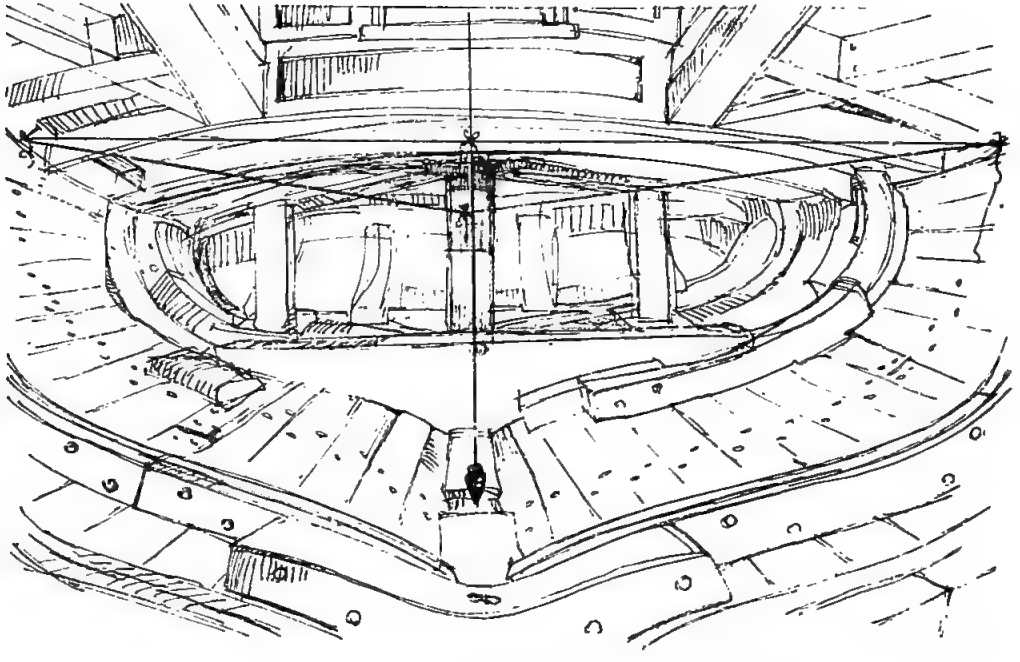
Frame sections or futtocks are doubled and bolted together

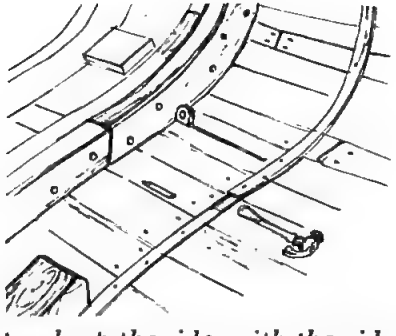
at a time, to prevent serious weakening of the boat. Care was taken not to pull the spike head through the cedar planking, and as old frames were removed, new ones were installed. Shoring on the outside held the vessel's shape during reframing. Old spikes were driven out from the inside, their holes plugged with whittled cedar plugs and then bunged. The bungs were set in epoxy.

Although built originally with natural crook or steam-bent oak frames running in one piece from keel to sheer, the new frames were made up in pieces (futtocks) sawn from straight-grained white oak planks and bolted together in what is known as the double-sawn method of framing. Curved oak timbers of suitable length were not available to duplicate the original natural crooks nor were facilities for steam-bending timber of that size. Floor timbers of hackmatack crooks reinforced the new frames at the sharply rising ends of the vessel. Fastenings throughout were bronze.

The fabrication of a new frame began by establishing points on the keel and sheer representing its center. There was a tendency for the frames abaft the waist to lead aft, herringbone fashion, unless these points were fixed. String was run athwartships from points marking the centers of the frame tops on each side at the sheer. From the middle of this line a plumb was dropped to the keel to a point 20″ from the center of the adjacent frame. This test and one that measured and found equidistant the distance from frame tops one each side to the center of the rudder post insured the alignment of the frames. With points on the keel and each sheer, the plane of the frame was established and battens could be placed up the sides and

Aligning the new frames. Lines of equal length from the rudder post to the sheer locate the positions for the tops of the frames. A plumb is dropped from the middle of a line athwartships connecting these points. This marks a point on the keel which is the bottom of the frame.

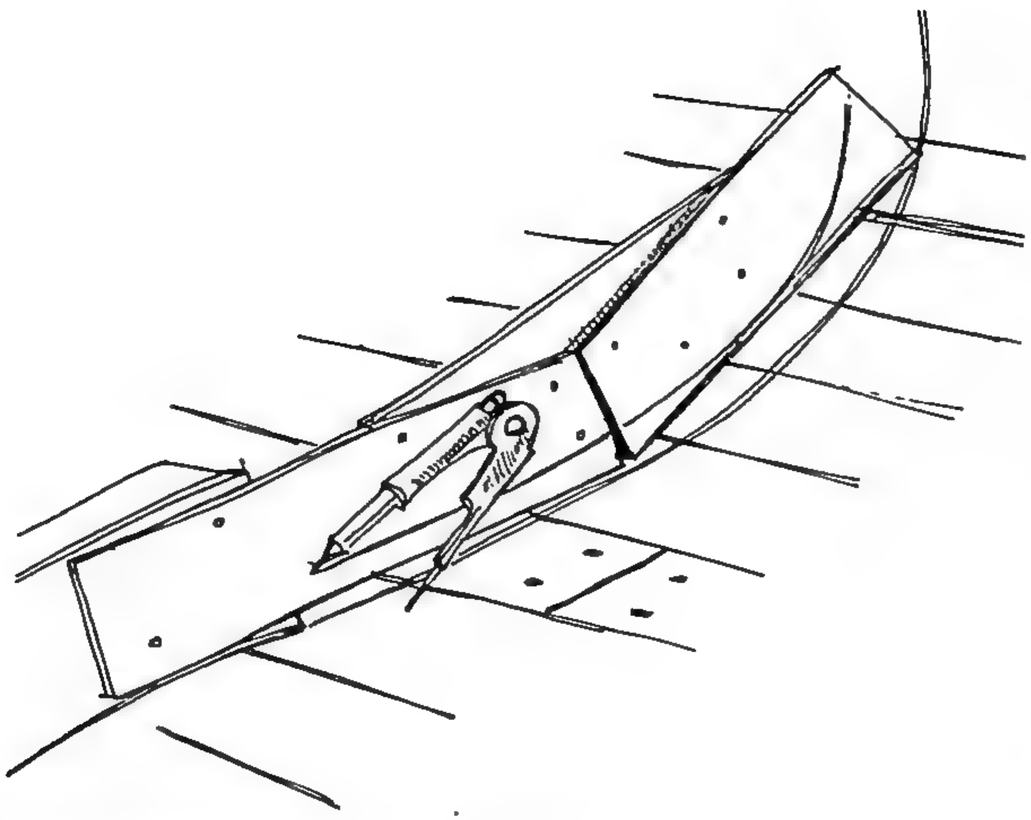




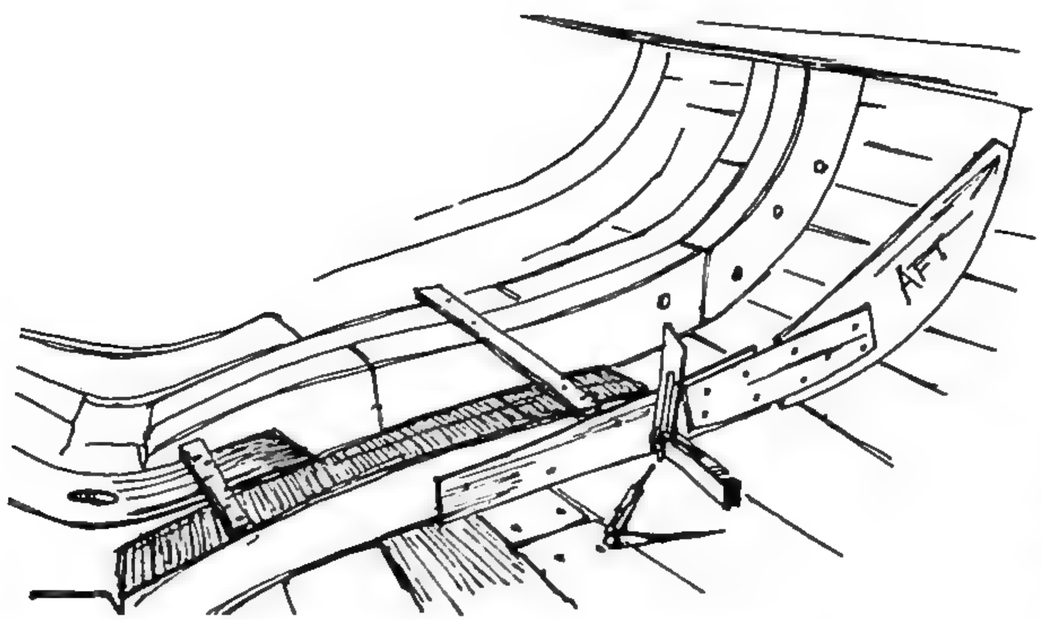
A line is struck up the sides with the aid of battens

lines struck on the planks. These marked the center line of the new frame.

Patterns were made of thin, wide pattern stock, placed vertically along the lines up the sides and scribed with a compass. After cutting and fitting the patterns, each was held at the proper angle to the planking by sighting along the reference line over the



Scribing the pattern for the frame



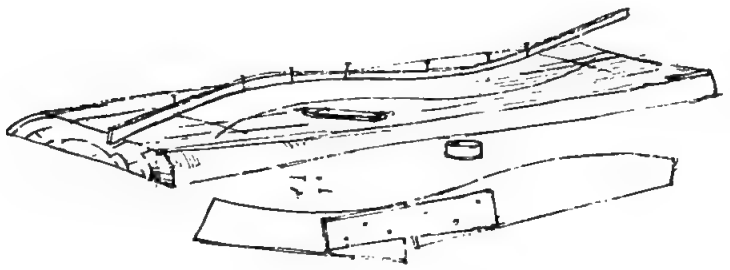
Securing the bevels at points along the frame

top of the pattern or by holding a straight edge along the pattern and checking its alignment with the line. Bevels were taken off between planking and pattern. Patterns the full length of the frame, in some cases a curve 9′ long, were rarely practical because of the length, and at some places in the hull three or four bevels were taken for one futtock.

The frames were doubled pieces of 2¾″ oak, making a total frame siding of 5½″. In most frames, three futtock pieces were used between the keel and sheer. These pieces were at least 2′ long, and the overlap of the butts of the doubled pieces was 12″. In the quarters of the *Berry,* this amount of overlap and futtock length was not possible above the turn of the bilge, where the sharp turn and tumble home called for shorter sections.

The patterns were laid on the oak planks in a manner to take advantage of any sweep to the grain; however, most pieces were cut from relatively straight-grained stock. The pattern gave the bottom edge of the frame, while a rough line for the top edge was struck with the aid of a batten. The depth of the rough frame was 5½″: later, after fit-

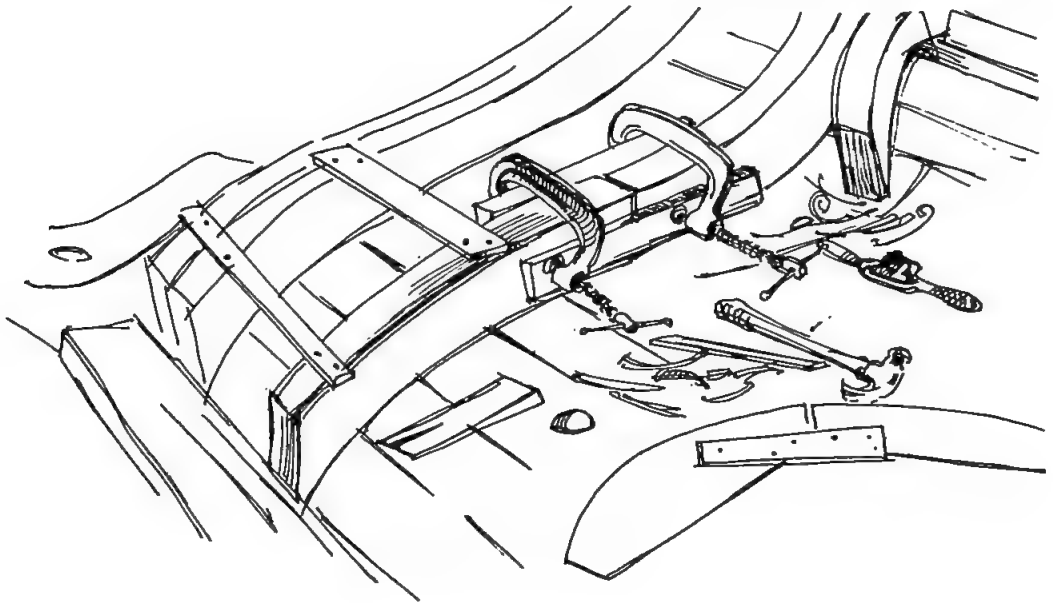
Marking the oak timber with the outline of the futtock



ting, it was trimmed to 4½". With the bevel gauge, the table of the band saw was set and the plank cut. Where several bevels were necessary, short cuts were made and the table reset. On larger work this operation may be simplified with the tilting-head ship saw.

The timber was then carried to the vessel for fitting. Laid along the reference line running up the side, its outline was traced and the area inside chalked. The piece was fitted by shaving its bottom surface with chisel, plane and spokeshave until chalk marks showed a tight fit at all points to the plank-

Shaping and fitting with plane and spokeshave. The planks are chalked to secure a tight fit.



ing—a time-consuming process which would not be encountered in building a new vessel. The piece was then trimmed to its molded depth of 4½", the top surface being given the same bevel as the bottom. Later the ceiling (inner planking) would lie on the inner surface.

As each piece was made, starting at the keel and working up the sides, it was temporarily secured with cross battens to the next frame. The next piece was then shaped and placed until that half of the frame was complete from keel to sheer. It was checked for straightness and fit, and the pieces of the other half of the double frame were made up in the same manner, care being taken to give enough overlap at the butts to make a strong joint. Where possible, butts of adjacent frames were staggered. After a final check for fit, the frame was disassembled.

Into the end of the top piece, where it butted against the covering board, a hole ½" wide and 6" deep was drilled into the end grain, filled with linseed oil and bunged. This reservoir of oil seeps into the end grain and prevents rot. The other surfaces were coated with a pentachlorophenol preservative. Any loose knots were graved out and the holes filled with epoxy.

Pilot holes for the plank fastenings were drilled from the inside, two to a plank, staggered, one fastening on each of the doubled frames. The frame was then reassembled and secured with wedges and clamps. On the outside of the hull, holes were countersunk for ⅝" bungs and drilled for the 3½" No. 16 bronze screws. These fastenings were then driven with screwdriver bit in a brace or an impact wrench, and the holes bunged with cedar set in epoxy. About four dozen fastenings went into each frame.

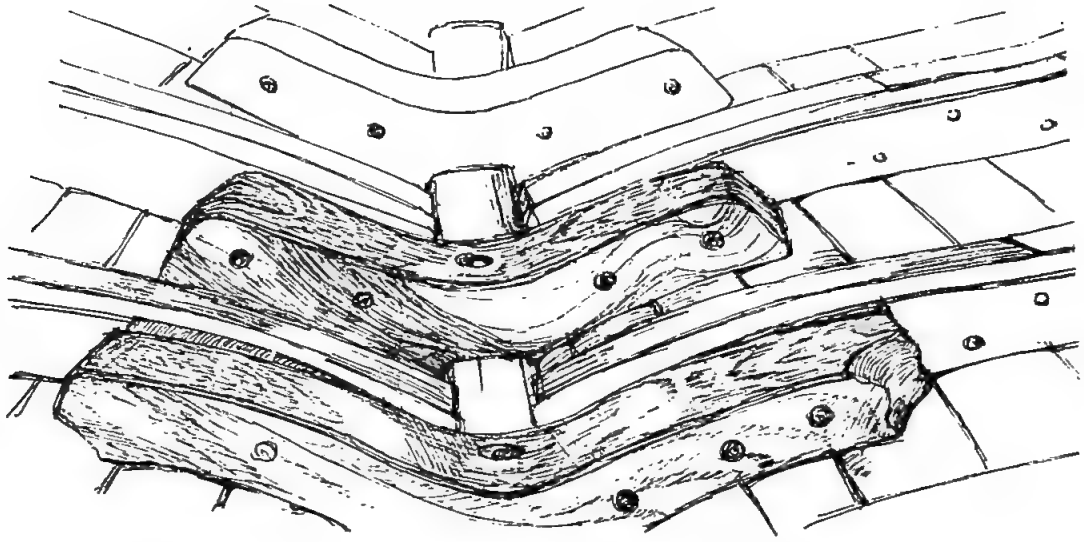
The frames were drilled and bolted with ⅜" bronze carriage bolts. Two of the 6" bolts were placed, staggered, on each side of a butt. Eighteen to twenty bolts held each frame together. Those frames at floor timbers were through-bolted to them with two or three bolts. As timber for the frames was unseasoned, there was shrinkage after several weeks and the bolts holding the frames together required further tightening. The final work was smoothing the top surface of the frame, fairing uneven butts, and beveling the edges.

Chapter IV

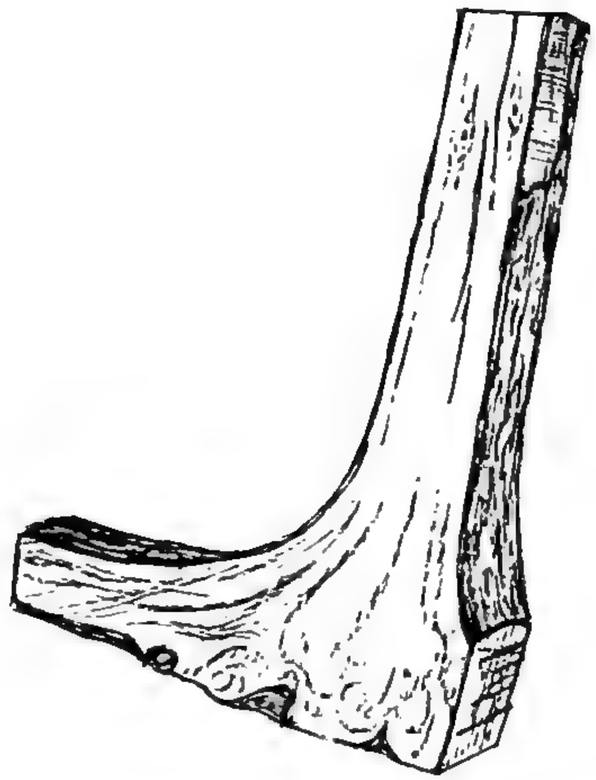
FLOOR KNEES

EIGHT new floor timbers were placed in the *Berry* during reconstruction, either natural crook hackmatack or oak knees. A supply of the former was cut for the Seaport in Maine, and used in construction in the *Charles W. Morgan* as well as the *Berry*. The oak knees were recovered from the water off Noank where they had lain forgotten for fifty years. They were found in the course of dredging and pier construction and acquired by the Seaport.

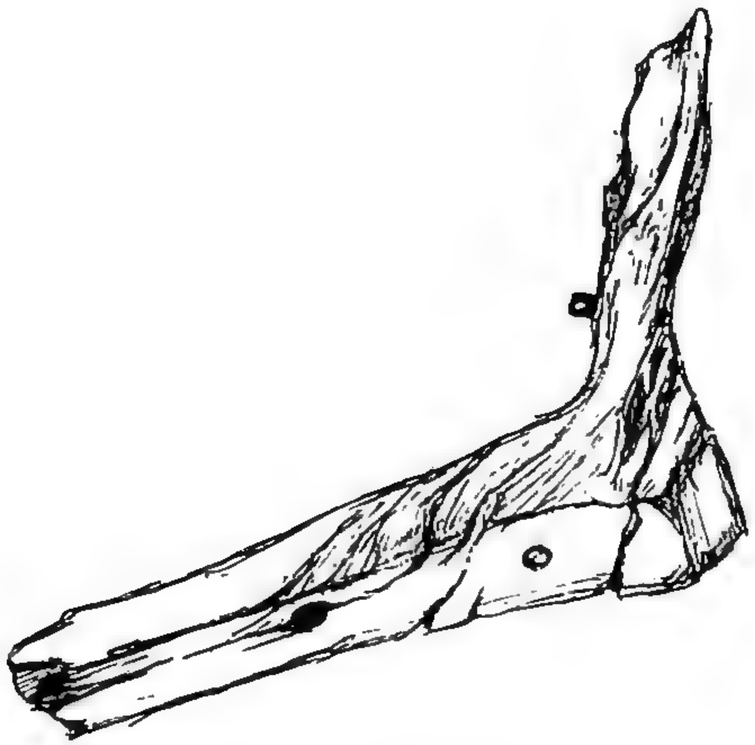
The knees are cut from the base of the hackmatack or tamarack tree. One arm of



Hackmatack floor timbers or knees



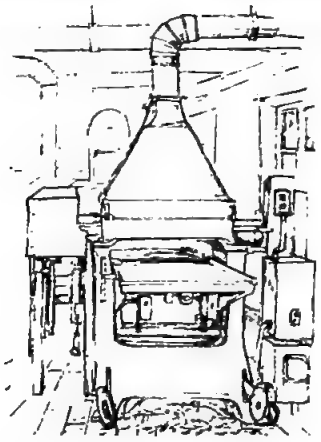
The knees as received at the Seaport. The longer arm in the illustration is the trunk.



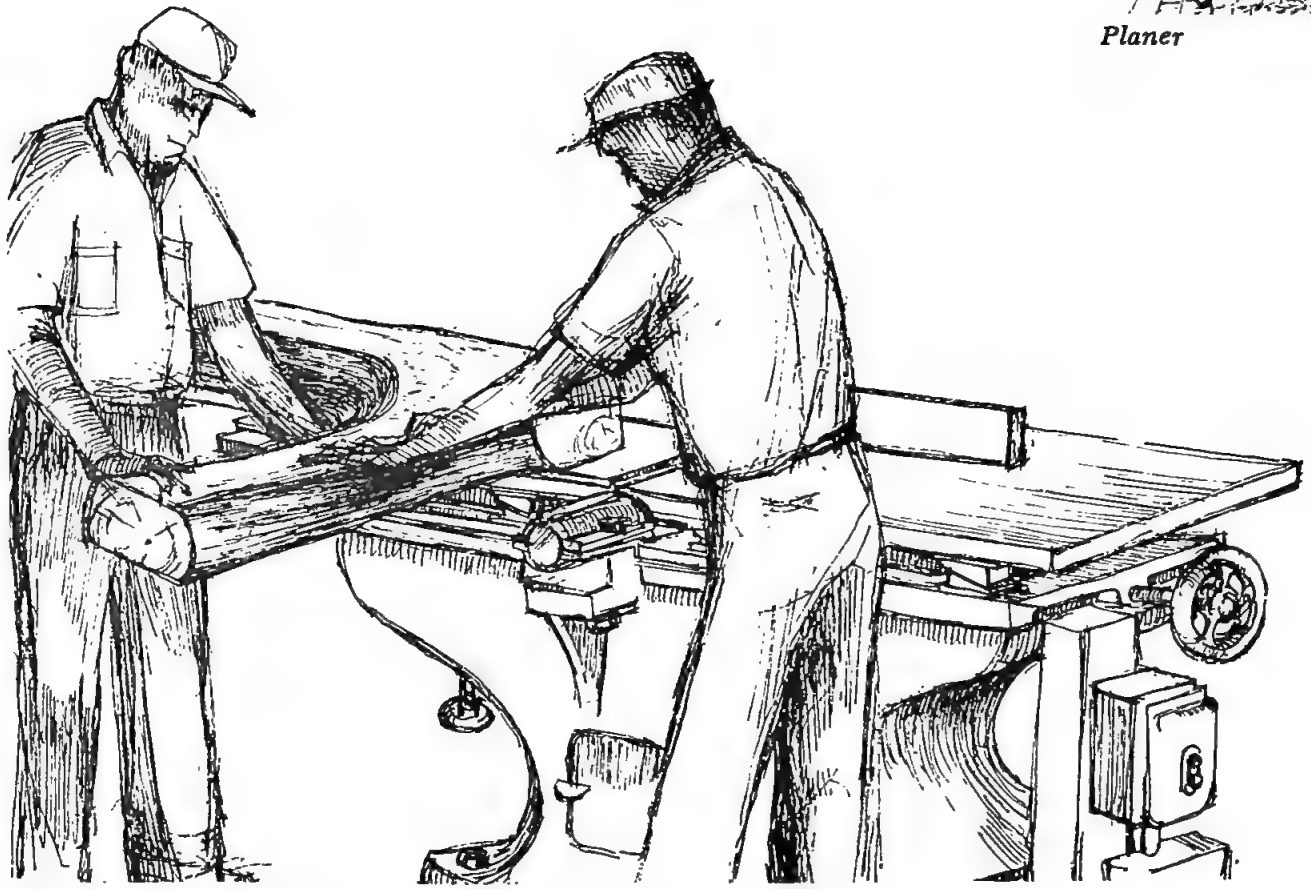
An old floor knee with holes for treenails

the crook is the trunk and the other a major root growing at the surface of the ground. A crook with the grain sweeping more than 90° is possible from the hackmatack tree. The wood is durable and easily worked, which adds to its usefulness as a boatbuilding material. In the reconstruction of the *Berry,* extreme angles in the knees were not needed, the greatest being about 120° in the floors in the bows.

Six of the knees in the vessel were sound enough to be saved and those not fit were cut up and removed in pieces. (Some were found bored for treenails, which suggested original pieces.) Most of the floors were fastened to the keel with iron drifts but these bolts were rusted to extreme thinness or gone completely. The planking was fastened to the floors with ship spikes and the frames were bolted to the knees with iron. After the removal of the old floors, the remains of the old iron drifts in the keel were drilled out with a ¾″ drill to a depth of about 6″. The holes were filled with cedar plugs set in epoxy as were the smaller holes in the planking left by the spikes. The floor timbers that were removed had become too deteriorated



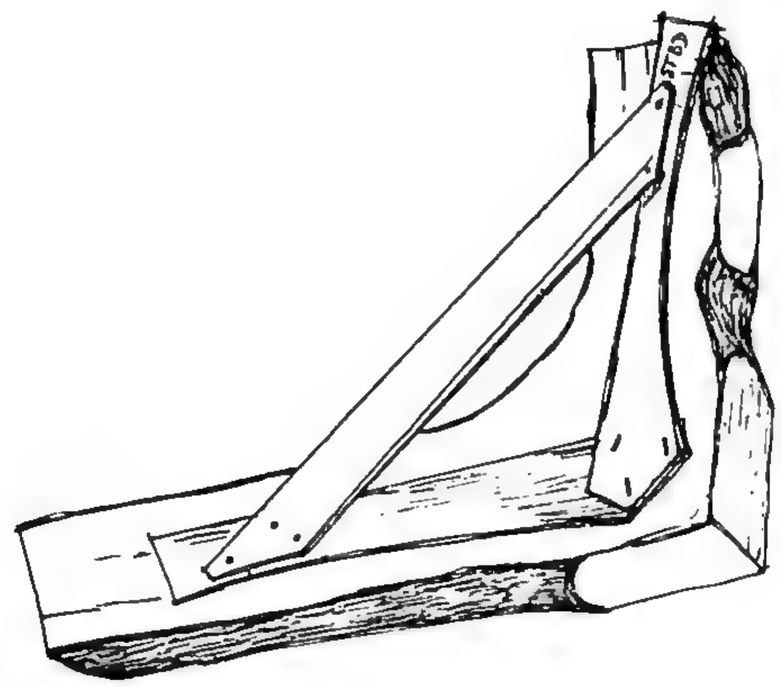
Planer



Joiner is used when the knee is too large for the planer

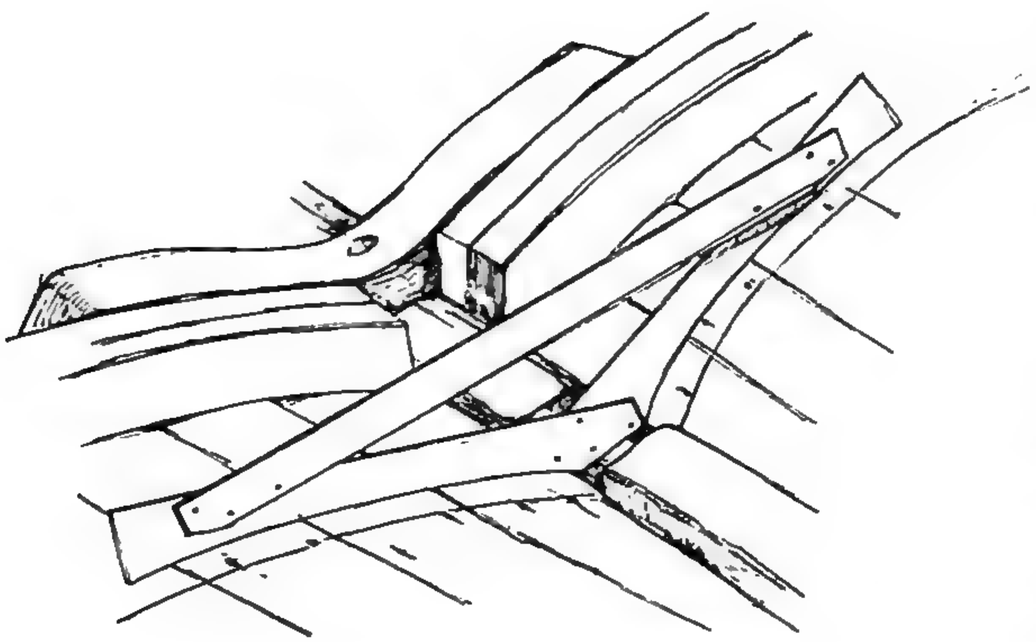
or ill-fitting to serve as models for the replacements. Shims and what appeared to be folded tar paper filled the gaps under some. Others had openings as wide as ½″ between planking and timber.

Patterns were made and scribed. Since the floors were from 5″ to 6″ thick, the bevel sometimes changed between foreward and after sides of the timber. Methods varied: one made the pattern to the centerline of the floor and the bevels were taken along this line. Despite this use of the average, considerable fitting was necessary later. The pattern was held plumb with the aid of a level while bevels were taken with a bevel gauge.



The pattern is laid on the knee to take advantage of the sweep of the grain. The outline is then marked.

The stock of knees was then examined and one with the grain best matching the pattern was selected. The wings of the floor timbers were made as long as possible for greatest strength: most of them extended from 20″ to 30″ athwartships from the center of the keel. The depth of the knees—4½″—was the same as that of the frames. When delivered, hackmatack knees had two flat sides cut with a chain saw while the



Pattern for a knee

Knee being cut on the band saw. Under and top surfaces are cut with a bevel.

stump lay uprooted on the ground. The thickness of the timber was between 8″ and 8½″. The crooks were passed over the joiner and through the planer to trim the timbers to a thickness of 5″-6″. Two men were needed to handle the pieces because of their weight and awkward shape.

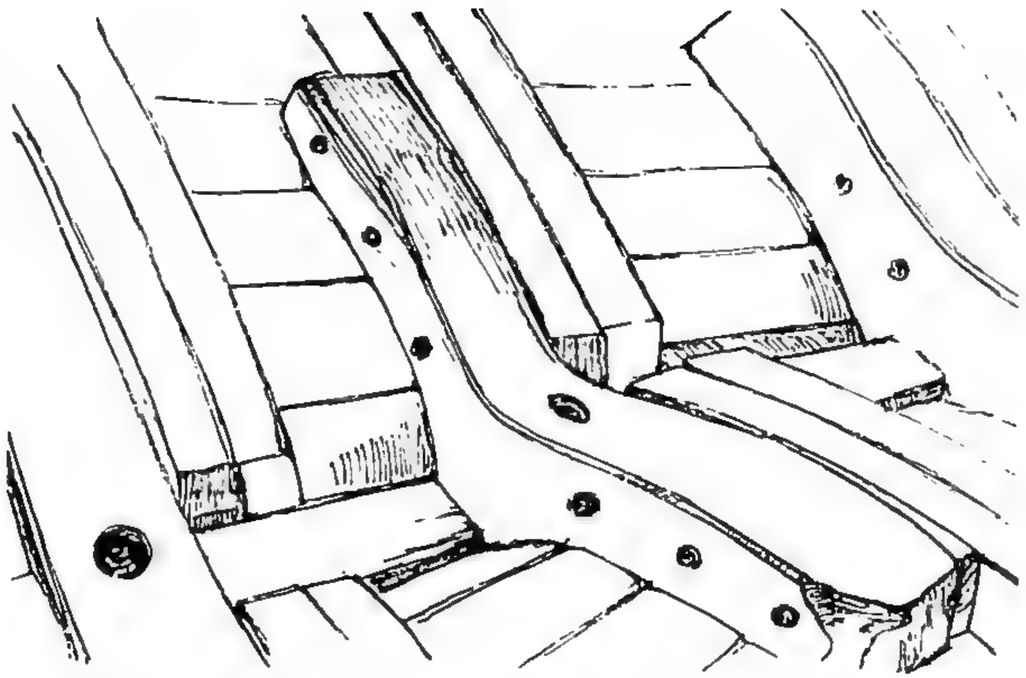
Next, the patterns were laid on the knee and shifted to various positions to find the best grain and longest wings. The outline was drawn and the excess wood roughly trimmed with a hand saw or chain saw. The knee was then taken to the band saw and cut along the lines marked from the template: the table of the saw was set at the bevel taken between pattern and planking. Up to this point in the work, power tools, the planer, joiner and band saw, had been important labor-savers. Without them, the adz and the broad ax would have been brought into use.

The floor timbers were next fitted in the boat. The roughly shaped and beveled timber was laid in its position athwart the keel and its outline marked; it was then moved aside and the outline area chalked. The piece was next returned to its place, jiggled and rocked, and then turned over and

checked for fit. Chalk on the bottom surface marked places for trimming. The ship carpenter used chisel, spokeshave and plane for shaping the bottom. As a rule, many trials were necessary before the chalk marks and eye showed a good fit between planking and floor timber.

Any knots in the timber were cut out and the hole filled with epoxy: bark and sap-

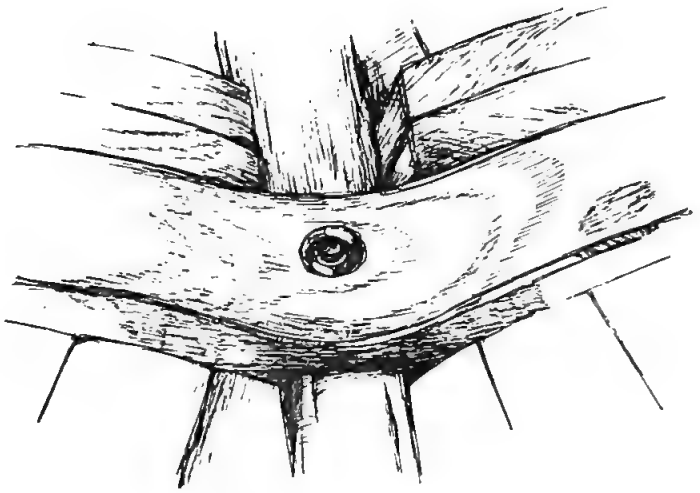
Shaping and fitting the knee



Knee fastened to the frames with bronze through bolts

wood, sometimes found on the root end of the crook, were chiseled away. The underside of the timber was treated with a pentachlorophenol preservative, and the knee was laid down in its place for fastening. Two 3½" No. 16 bronze screws per plank were driven from the outside through the planking into the knee.

The floor was left thus while the frame which lay against it was built. The two were then bolted together with ⅜" carriage bolts, each 12" long—two or three of these bolts were used depending upon the length of the



Counterbored lag screws fasten knee to keel

floor. Where width of bays between floors did not allow the use of a single long bit, a number of bits, each longer than the last, was used to drill the bolt hole. In some cases, the holes were drilled before assembling the frames. Frames and floors did not always lie flush together because the bevel of the knee threw the ends away from the frames. In these cases, wedge-shaped shims of white oak were fitted into the gaps.

The floor knee was then bolted to the keel with a ¾″ bronze lag bolt 12″ long, and the head well countersunk. Top surfaces of knees and frames were made fair, the bevel being the same as that of the underside of the floor, and all edges were champfered with the plane.

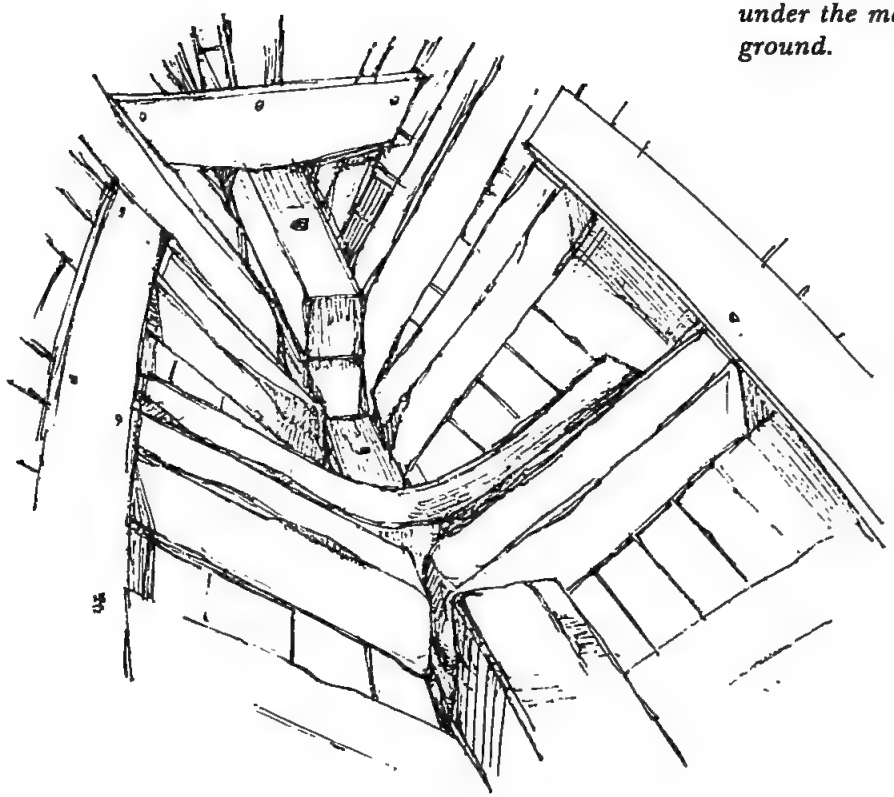
The floor knees are at alternate frames in the middle section of the *Berry* where the keelson lies on top of the floors. Through fastenings of bronze bolts ¾″ in diameter pass through keelson, knee and keel. The frames of the *Berry* are doubled, and those in the waist without a floor timber have a short end of the bottom futtock lap over the keel. It is then bolted to the frames on the opposite side.

Chapter V

MAST STEP AND KEELSON

WHEN the masts of the *Berry* were unstepped before hauling, the step of the foremast came loose and was lifted with the mast: a supporting timber for the step between the end of the keelson and the stem knee was found to be loose and rotten. In new construction, the keelson generally runs from the stem knee to the deadwood aft and the mast is stepped upon it. In the *Berry* the foreward end of the keelson had rotted and been cut off and a piece spliced in its place to support the step. This piece, about 6′ in length, was scarfed to the stem knee foreward and its after end lapped the cut-off keelson. Drifts had secured it to these timbers and to the two rotted floor knees beneath. The result was that the full weight of the foremast bore upon the keel at one point rather than being distributed upon several floor timbers. Probably this condition opened the garboard seams and accounted for the severe leaking foreward.

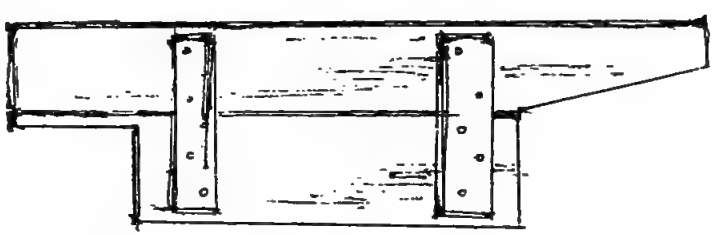
The keelson was perhaps original, though some sloops were built without them. Since the remainder of it appeared sound, it was decided to remove it while all rotted floor



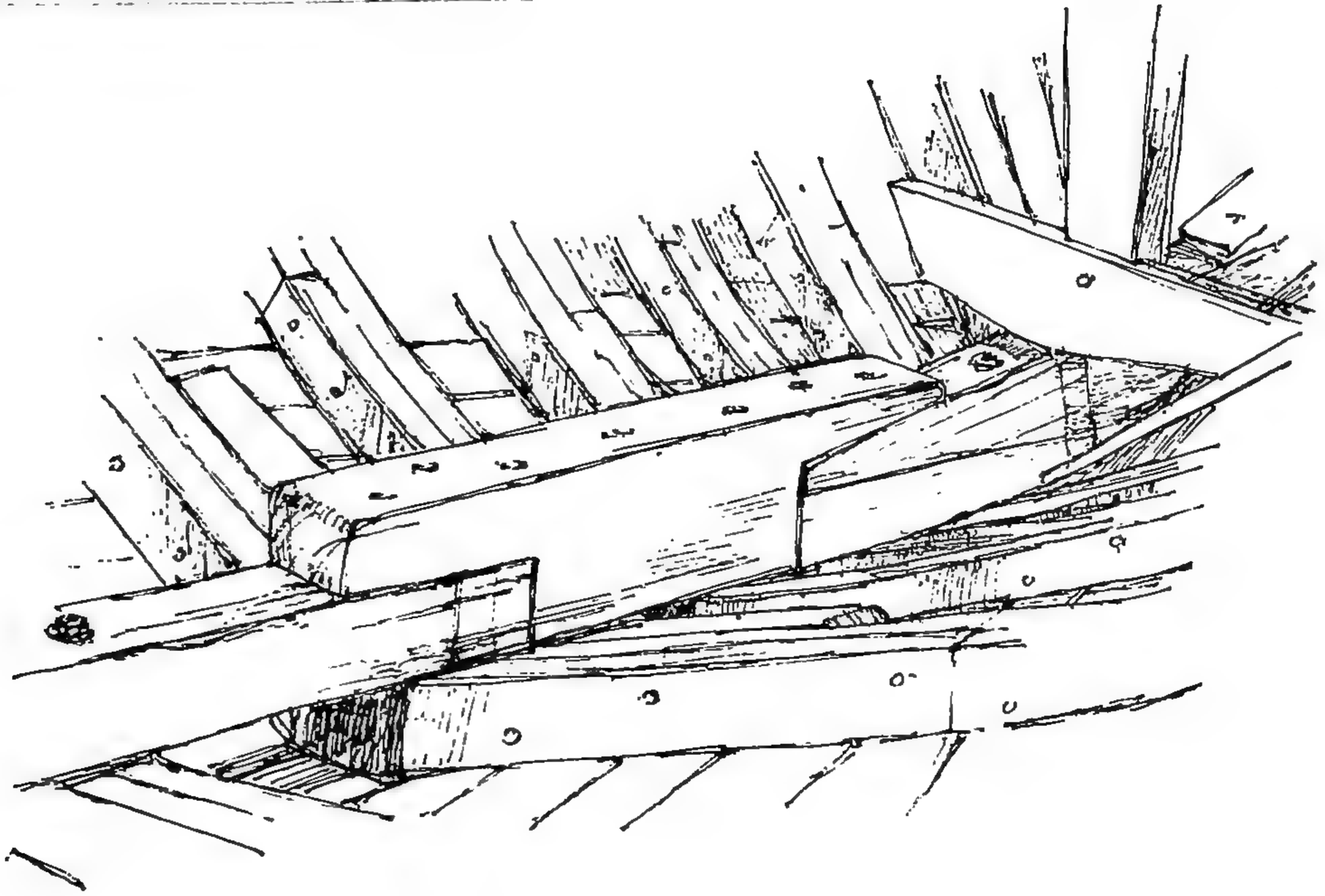
Foreward in the Berry *after removal of the rotted timber under the mast step. The end of the keelson is the foreground.*

knees were replaced and then put it back, through-bolting it to the keel. The spliced piece between it and the stem, being rotten, would be replaced.

When all floors were replaced, a pattern was made of the profile of the timber between keelson and stem. A piece of oak 5″ thick, 14″ deep and 7′ long was marked and



Pattern for the timber under the mast step



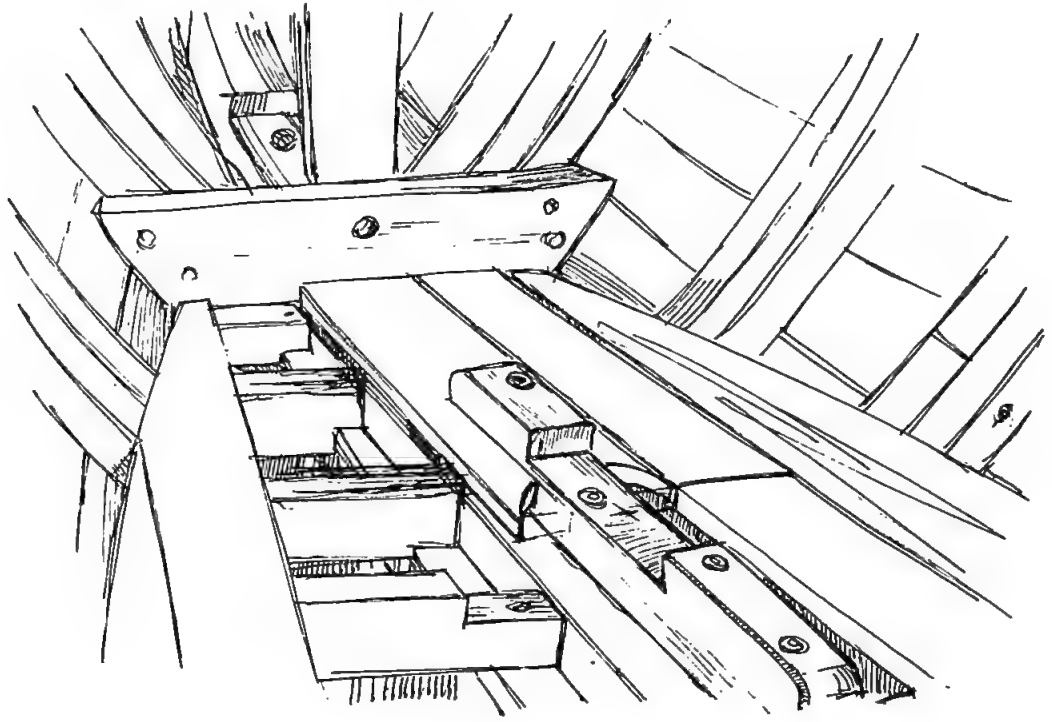
New support for the mast step. The timber is through-bolted to the keel.

cut on the band saw and then fitted. The scarf joint at the foreward end was 17″ long and the overlap of the keelson 16″. Surfaces were chalked where the timber bore on floors, keelson and stem knee, and the piece was placed. It was then lifted out and shaped with a plane where chalk marks indicated high points. This was done a number of times until the fit was tight. The old drift holes in the keel were drilled out and plugged with cedar set in epoxy. The timber was then placed for the final time and bolted with six ¾″ x 31″ bolts to the keel. A lag screw was also driven into the stem knee.

The keelson itself was through-bolted to the keel. This required boring through 23″ of wood: 10″ of oak keel, 6″ of keelson and 7″ of floor timber, with a ½″ electric drill. The bit was aligned by eye with reference to a guide clamped plumb to the side of the

keelson: one man drilled while another sighted. Using a right-angle attachment to the drill, the holes were counterbored on the underside of the keel to countersink the nut. These holes were made 1¼" deep and after the nuts were taken up tight, they were packed with epoxy. A total of ten through bolts of ¾" bronze fastened the keelson.

The mast step is white oak, 35" long, 3" thick and standing 4½" high. The upper surface is notched to receive the slotted end of the mast, the notch being 1½" deep and 12¼" long, allowing wedging at the bottom to adjust the rake. The step is fastened down to the supporting timber with four ½" bronze drifts 9" long. These drifts have heads made by peening the ends, and a washer serves as a clinch ring. The step was laid in white lead and was treated with preservative.



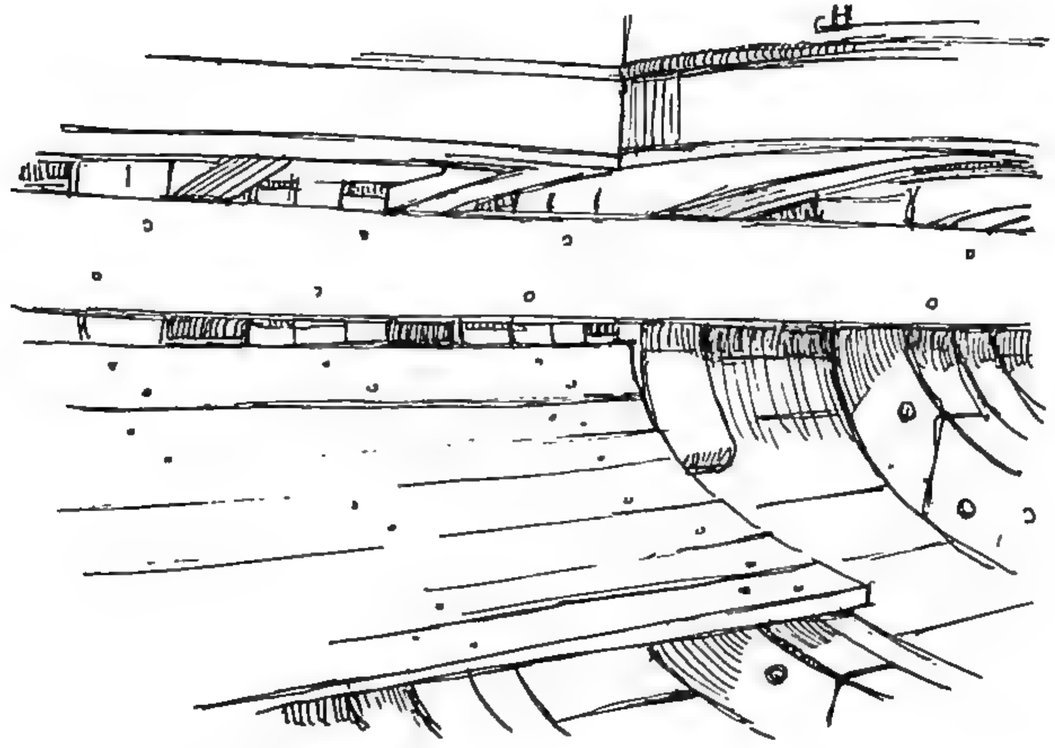
The new mast step drifted to its supporting timber

Chapter VI

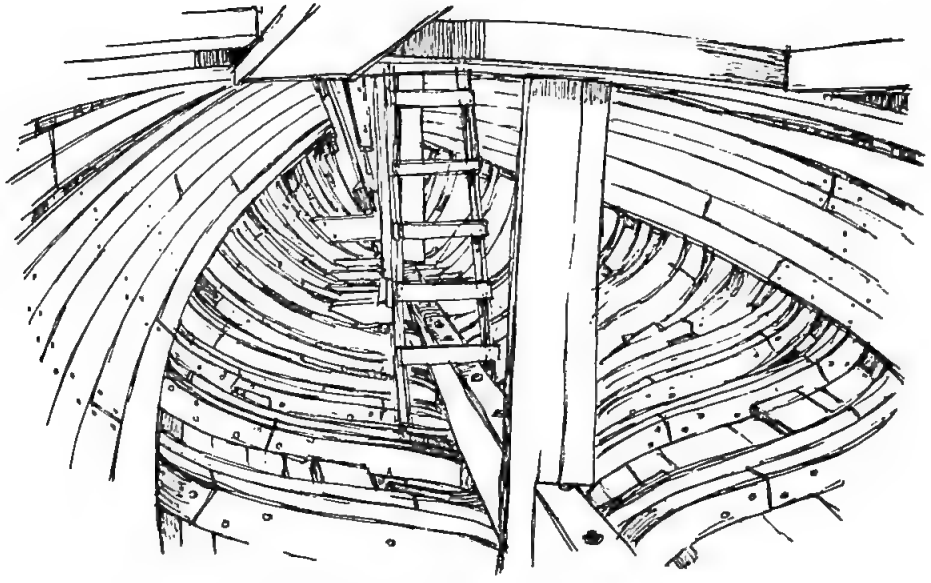
SHEER CLAMPS AND CEILING

SHEER clamps are strength members inside a vessel running full length where deck and sides meet. They are fastened to the frames and, besides tying them together, support the deck beams which rest on them. The ceiling is planking inside the frames and covers them and the bays between, making a finished interior. It also adds much to the strength of the vessel. Both clamps and ceiling were renewed in the restoration of the *Berry*.

The *Berry* did not have the usual sheer clamps when acquired. A shelf of 2″ x 8″



Starboard side aft. Clamps give support to the deck beams which rest on them. The ceiling covers the frames.



Looking forward. Clamps are in place; the vessel is half ceiled. Later the ceiling in the forecastle and in the cabin aft was continued down to the floor boards.

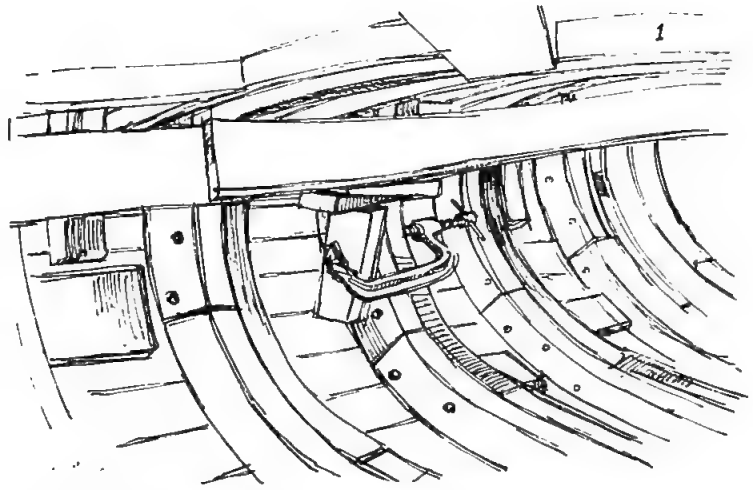
oak bolted to the deck beams in the area of the chain plates gave some strength normally provided by clamps. The ceiling—made of 2″ lumber—was unusually heavy. It was spiked to the frames, and perhaps contributed to the preservation of the craft's handsome lines, her sheer and relative absence of hog. It had to be removed because of rot and the need to replace frames beneath it.

Sheer clamps were installed as soon as framing was completed. There were various alternatives to the type of construction: the clamps may be one piece or laminated, edge set or spiled. Because it was easiest to build under the existing deck frame, it was decided to laminate in two layers and edge set. The finished clamp was built up of two pieces of longleaf yellow pine, each layer 1″ thick, selected because of its strength and rot-resistant qualities and because wide planks of clear stock were available. The clamps are 8″ wide from the bow to about two-thirds of the distance aft; from there they tapered or tailed to a final width of 5″.

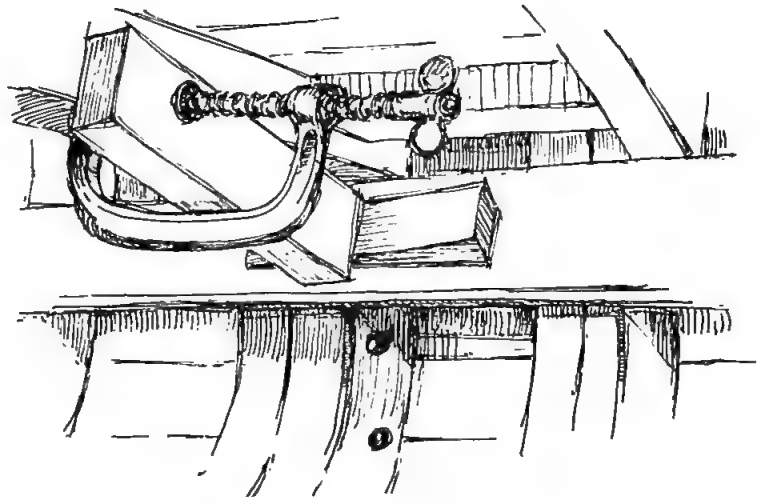
Three pieces butted together made a layer.

The pieces of the plank were sprung into place by wedging. The center plank of the three, when bent flat against the frames, lay up against the deck beams in the middle. The ends of the plank were approximately 3″ below the beams because of the sheer of the vessel. Blocks were clamped to the frames under the edge of the clamp and wedges driven to spring it edgewise up against the beams it was intended to support. The longer pieces of the clamp, 15′ in length, sprung more easily. Wedges were used at each frame and, using the same block and clamp arrangement, on the deck beams. Thus the sheer clamps were driven tightly against frames and deck beams. (Spiling is an alternative to edge-setting or springing, requires less forcing and may permit closer fitting. The edge that is spiled, however, is cut across the grain, which weakens the plank. Another consideration in spiling is that wider stock is required.)

The two bottom layers of clamp were laid, port and starboard, given a coat of red lead and secured to the frames with 2 ½″ No. 16 bronze screws—two for each frame. The



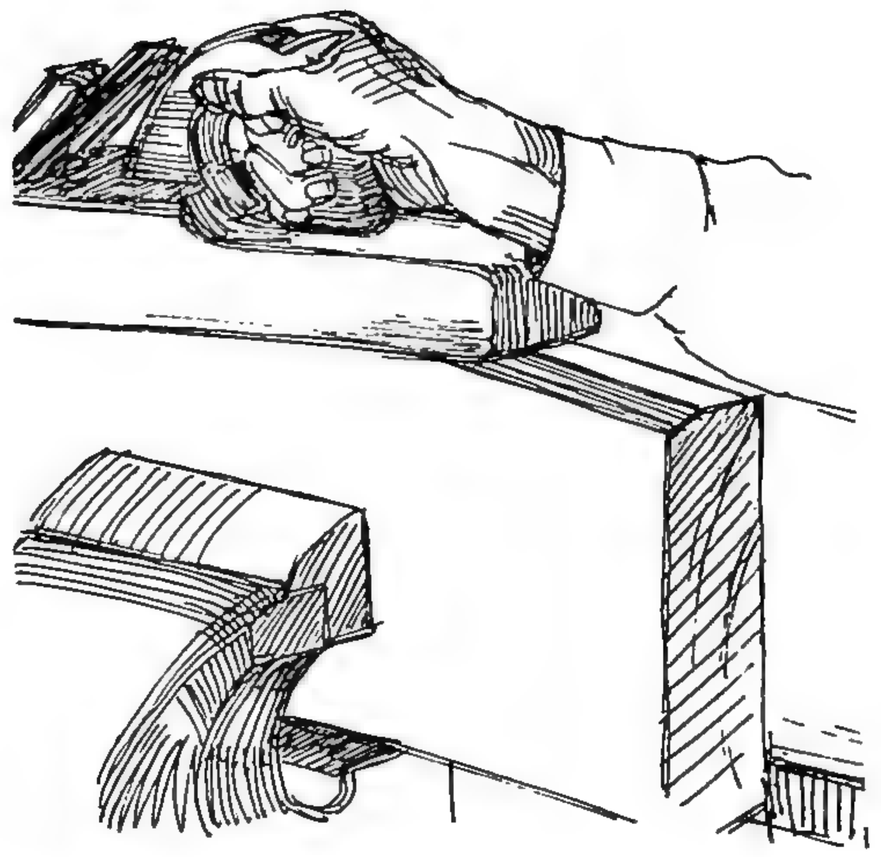
Clamp being edge set into place to follow the sheer. The clamps are tapered at the ends.



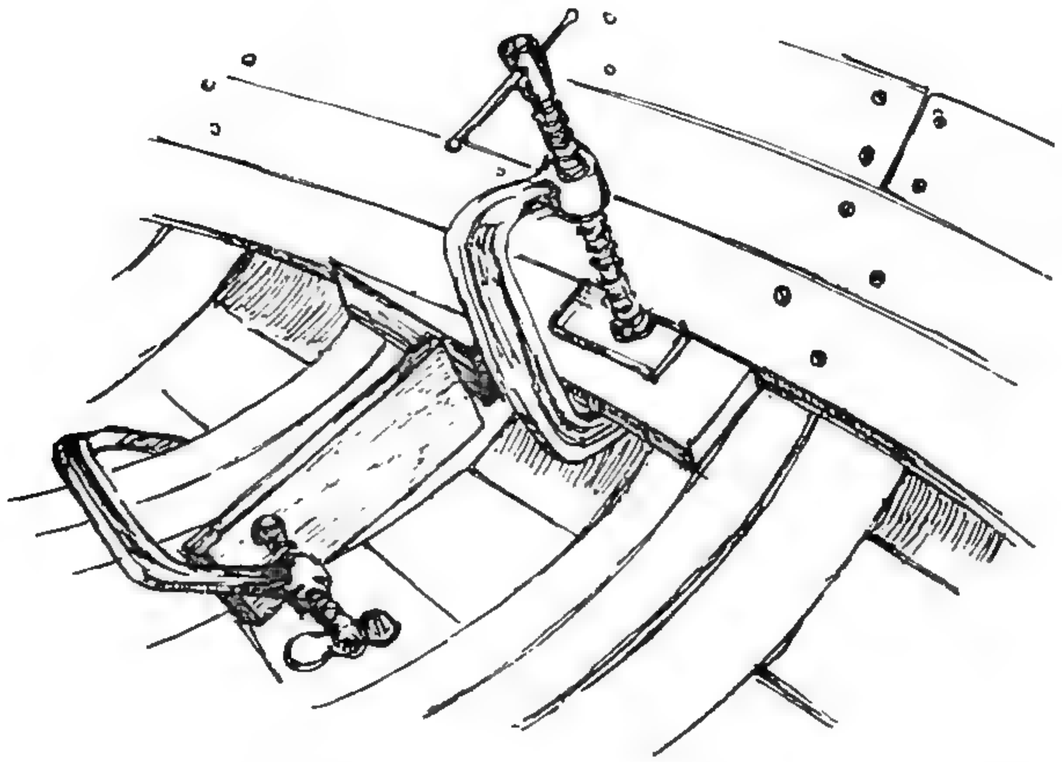
Wedges forcing clamps into place before fastening

second layer of three planks was then laid and secured with 3″ screws. The butts of the two layers were well separated for strength. The bottom edge of the outer plank was given beading and the whole treated with pentachlorophenol preservative.

The ceiling extends from frame No. 1 in the bow to No. 21 at the after end of the cabin. It is fully ceiled, that is, ceiled down to the floorboards and up to the sheer clamp in the cabin and forecastle. In the midships section, ceiling extends down the sides to the wet well. A 1″ gap was left between ceiling and sheer clamp for ventilation. Made of southern cedar, 1″ thick, it is caulked with cotton, a procedure which strengthens the vessel. Tight, caulked seams also make a neater job and contribute to greater cleanliness in the fish storage spaces around the wet well.

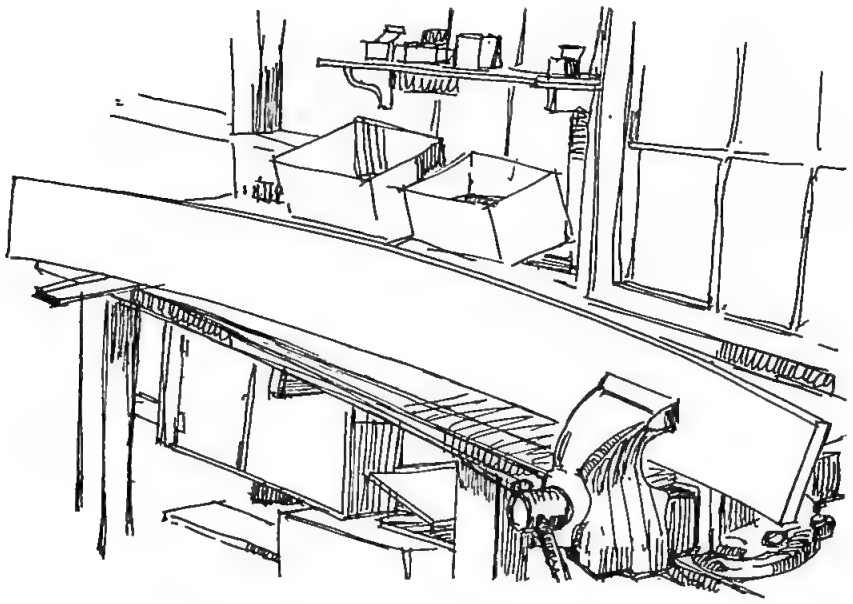


Planing caulking seam in ceiling plank



Ceiling planks being edge set. Seams were later caulked.

The strakes or planks making up the ceiling are tapered so that the width of all the planks at a given frame are the same. In the midships section, ceiling planks are 5″ wide, while at the foreward and after end

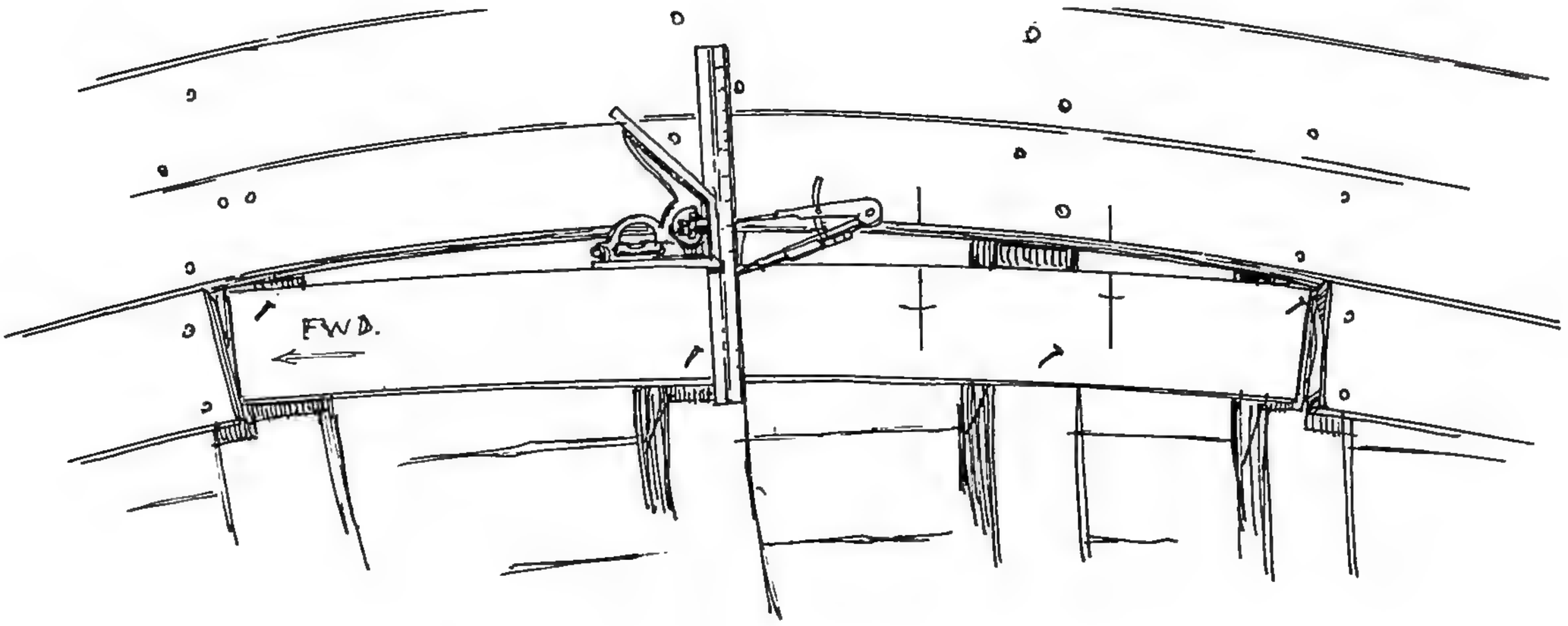


Spiled ceiling planks have a curved shape

they are narrower. Butts of the planks land on frames and are staggered. The same rule as for outside planking—butts of adjacent planks separated by at least two frames—was applied.

The first three tiers of planks were sprung and edge set, working from the clamp downward. The same method as used with the clamps—wedging the under edge to set it up against the plank above—was followed. The top edge of each plank was cut for a caulking seam and, where necessary at the turn of the bilge, beveled to insure a tight fit at the back of the seam. The caulking seam was planed to give an opening of 1/8" width and 5/8" depth. The butts were also cut for a caulking seam.

It was necessary to spile after the third tier of planks as they could be edge set no further without breaking. This sweep developed because of the fullness of the vessel in the waist. The function of spiling is to produce a curved edge on a plank that will fit the edge of another. When spiling is used, the edges will come together in a tight seam without edgewise forcing. The technique is

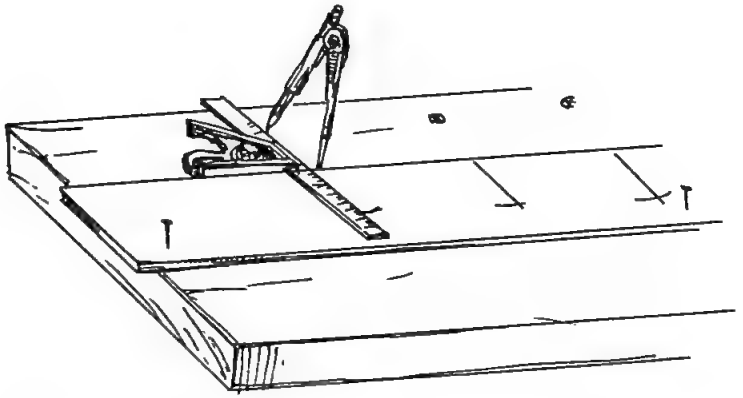


The distances may be accurately measured by placing a square on the edge of the spiling board. The compass is swung downward and a mark made.

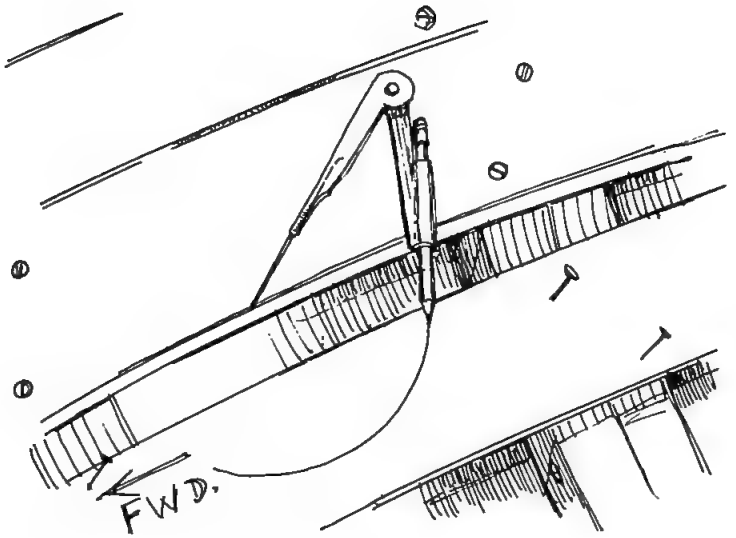
often employed in planking outside on the hull and inside in fitting the ceiling.

A spiling board is a wide, thin, limber piece of lumber roughly the length of the plank to be fitted. It is bent flat and temporarily nailed in place against the frames and care is taken not to edge set against the adjacent plank; a gap, of course, will separate the two. A compass is then used to mark points on the spiling board which, when transferred to the plank to be shaped, will establish the curve necessary to fit the plank.

There are various methods for marking the spiling board. In one, a square is used to strike a line at right angles to the edge of the board which carries across the gap on to the fitted plank. The compass is spread to the width of the gap and, with its point on the line at the edge of the spiling board, is swung down to intersect the same line. Thus the width of the gap separating the planks at that point is marked. This is done at intervals along the plank. The points establish a curve that is the mirror image of the edge to



The square is used again when the measure is transferred to the plank to be cut. The distance up from the edge of the spiling board is marked.

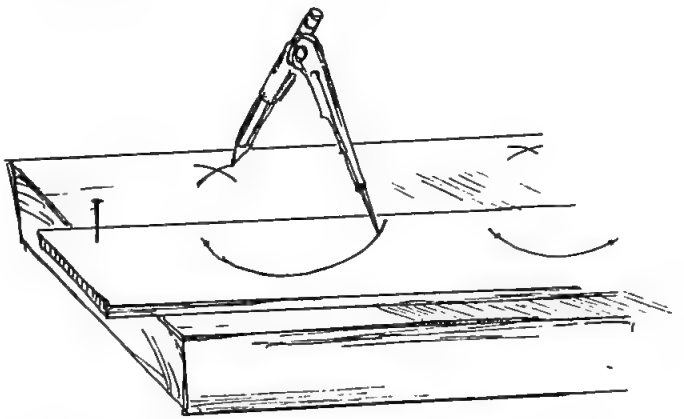


An alternative spiling method uses arcs. The same radius is used at various points along the board. The compass point is placed on the edge of the ceiling plank above and an arc scribed on the spiling board.

be cut. The spiling board may then be taken up and laid on the plank to be marked, and the points transferred up from the edge of the board with a square and compass.

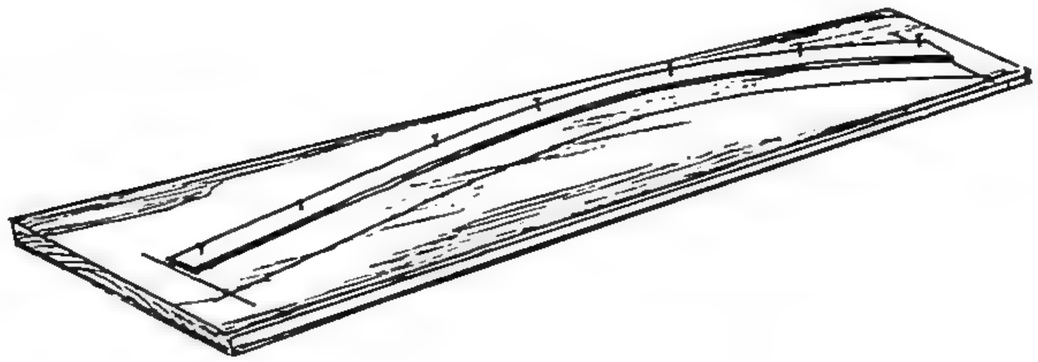
In this method, if the spiling board is not as wide as the gap between the planks, the distance may be marked with the compass along the edge from the point where the separation was measured.

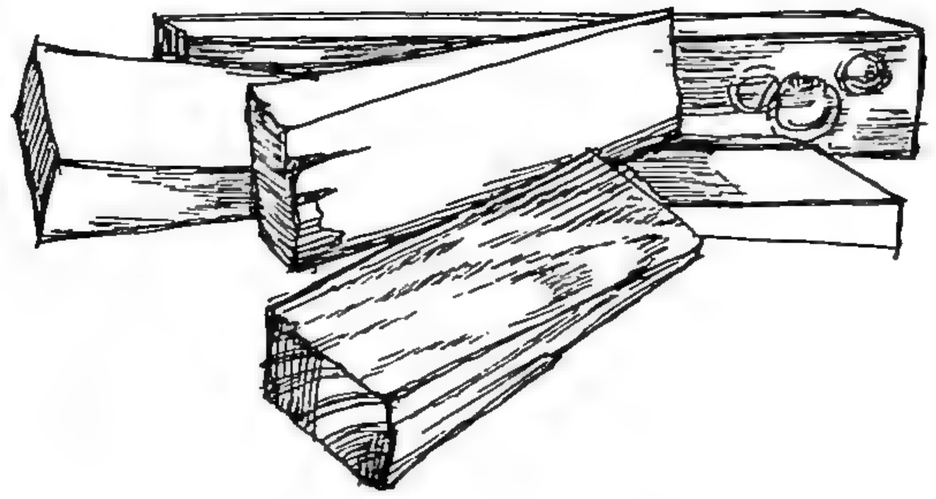
Another technique does not use the line at right angles to the edge of the spiling board but keeps the compass at the same set-



Using the same radius, two intersecting arcs are then swung from points on the arc on the spiling board. The intersection is a point on the edge to be cut.

A batten is sprung through the points and a curve drawn





Oak wedges and blocks are used in springing the planks into position. If the planks have been spiled, little or no edge-setting is necessary.

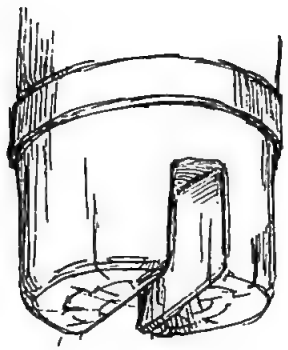
ting throughout the operation. With the point on the edge of the plank that is in place, an arc is swung onto the spiling board. This is repeated at intervals along the edge. The board is then taken up and laid on the plank to be fitted and the point of the compass, still with the same setting, is placed at two points on the arc and short intersecting arcs are scribed on the plank. The intersections mark points on the curved edge. A batten is then sprung through the points and a line faired. When the plank is cut along this line and bent flat on the frames, it will have an edge that will lie up against the neighboring strake in a tight seam.

The ceiling planks were fastened with bronze screws, 2″ No. 14, two to each frame, with the screws driven at a slight angle to set the plank against its neighbor. The under surfaces of the planks were treated with preservative before fastening. The seams were then caulked with cotton and faired with a plane before being puttied. Loose and rotten knots were plugged with cedar. Both the ceiling and clamps were given a light coat of varnish as a finish.

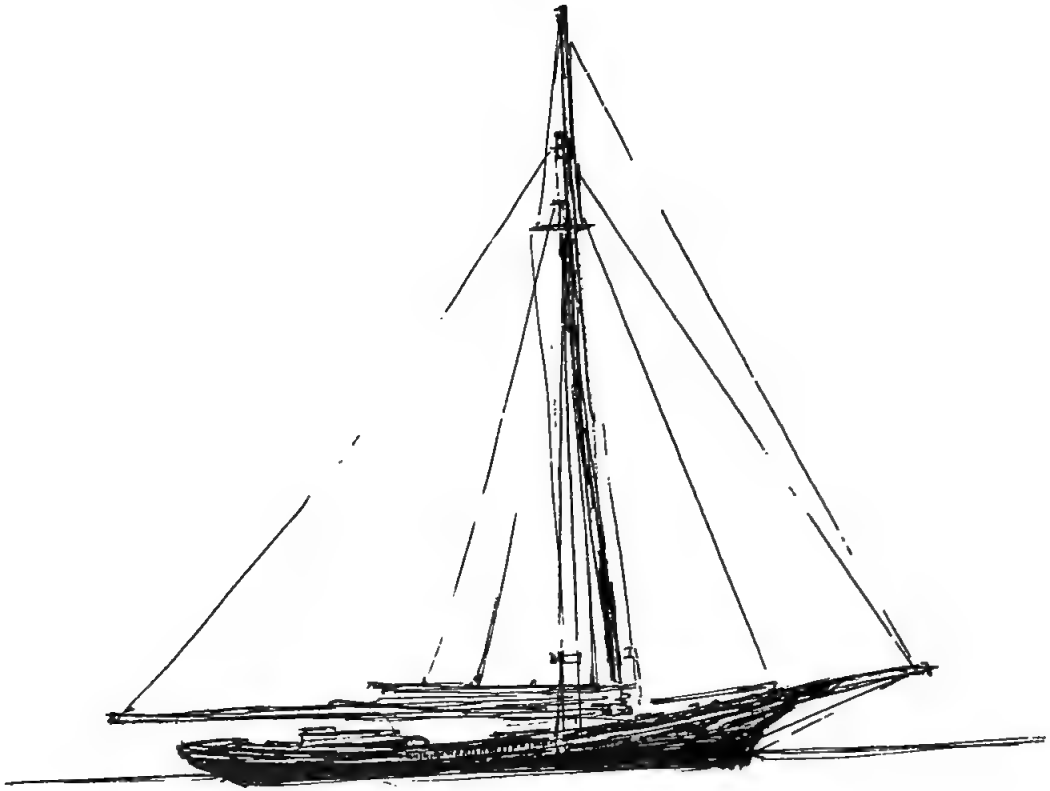
Chapter VII

SPARS

THE *Berry* was restored to the original sloop rig she had had before her conversion to a schooner. As a sloop, her spars consisted of a bowsprit, mast, topmast, boom and a gaff. The size of these spars was determined by studying and scaling old photographs of Noank sloops. The length of their masts from the deck to the top of the mainmast is approximately equal to the distance between perpendiculars of the hull. The topmast is a little less than half that length and the other spars were made proportionate. The diameters of



The mast step with slot and reinforcing iron band

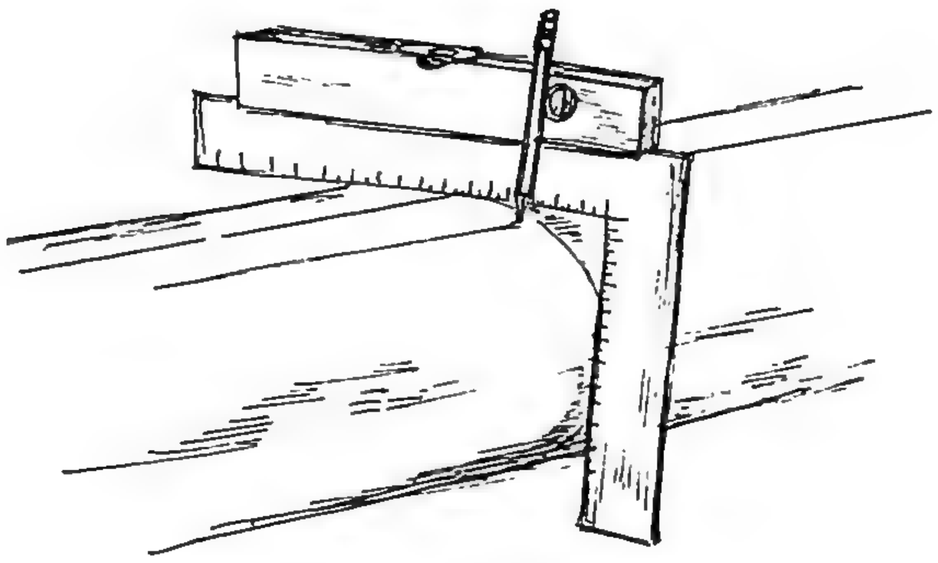


Noank sloop. The Berry *carries a single large working jib rather than the jib and staysail rig in this example.*

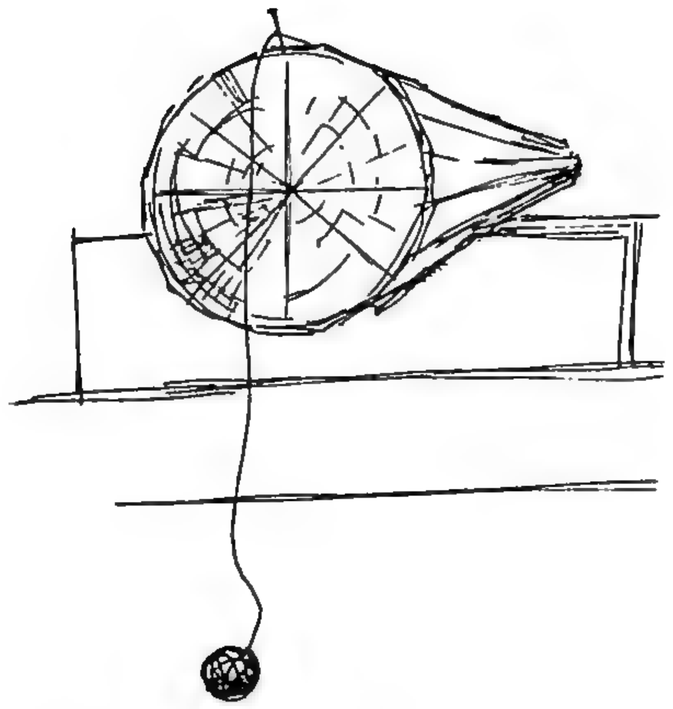
solid spars and the proper tapers are found in old tables of spar dimensions such as Lauchlan McKay's *The Practical Ship-Builder.*

The total length of the fir mast is 54′ 7″. The largest diameter, 11½″, is at the deck. At the step, the diameter is 10¼″. Above the deck the mast tapers. At one-fourth the distance to the crosstrees the diameter is 11⅛″; halfway it is 10½″; three-fourths, 9⅜″, and at the crosstrees, 8″. The masthead is square above the crosstrees, tapering in dimension from 5½″ on a side to 4″ and is 5′ 3″ in length. Here the topmast laps the mast and is held by two bands.

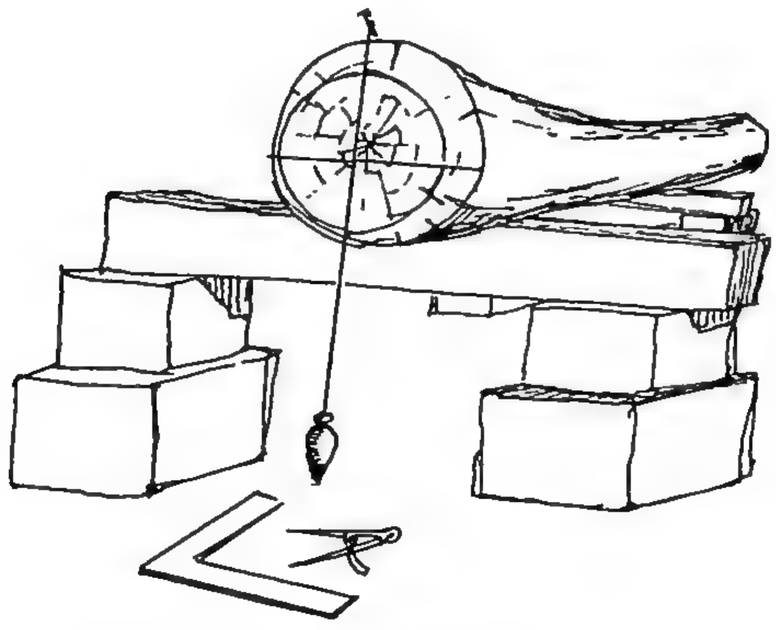
The mast was cut down from a spar salvaged from another vessel. Whether made from an old spar or a new timber, the procedure is the same: the timber is first squared. This is necessary when making large spars



A round timber to be cut down to a spar is first made square. It is then tapered. The lining-off to square the timber is done with a level and square.



A chalk line is stretched along the timber and plucked, striking a straight line.



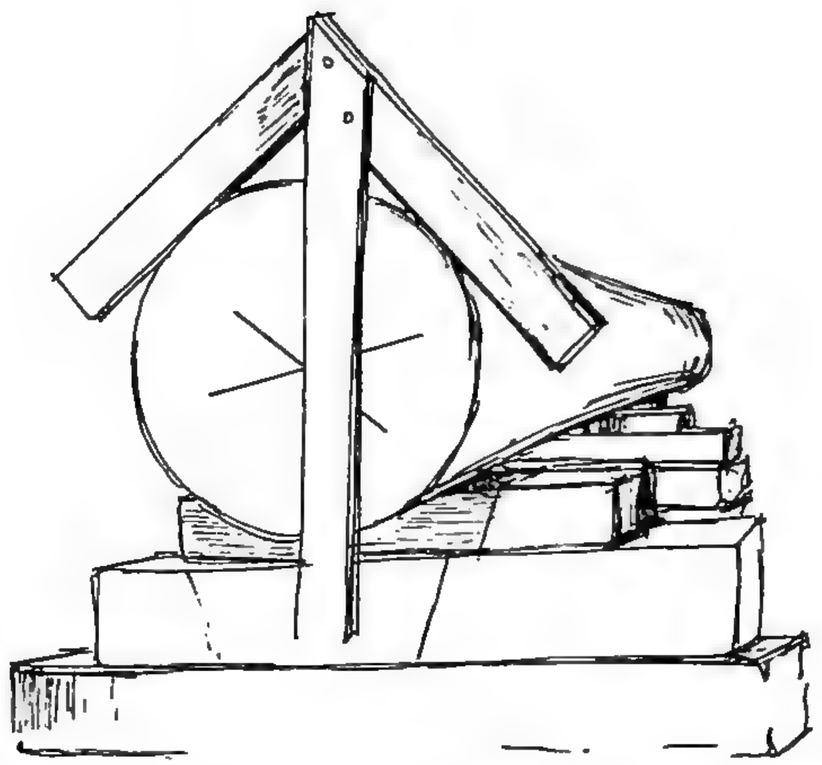
Plumb bob in use for finding center

by hand, for without a square timber to work from, a true, symmetrical spar, properly tapered, is difficult to produce. On the ends of the timber, circles are scribed with the finished diameters of the step and top. The centers may be displaced from the natural core of the timber in order to get a straight spar out of a piece with a set or bend. With a level or plumb, vertical lines are struck through the points selected as centers and horizontal lines at right angles are then drawn through the centers to the edges

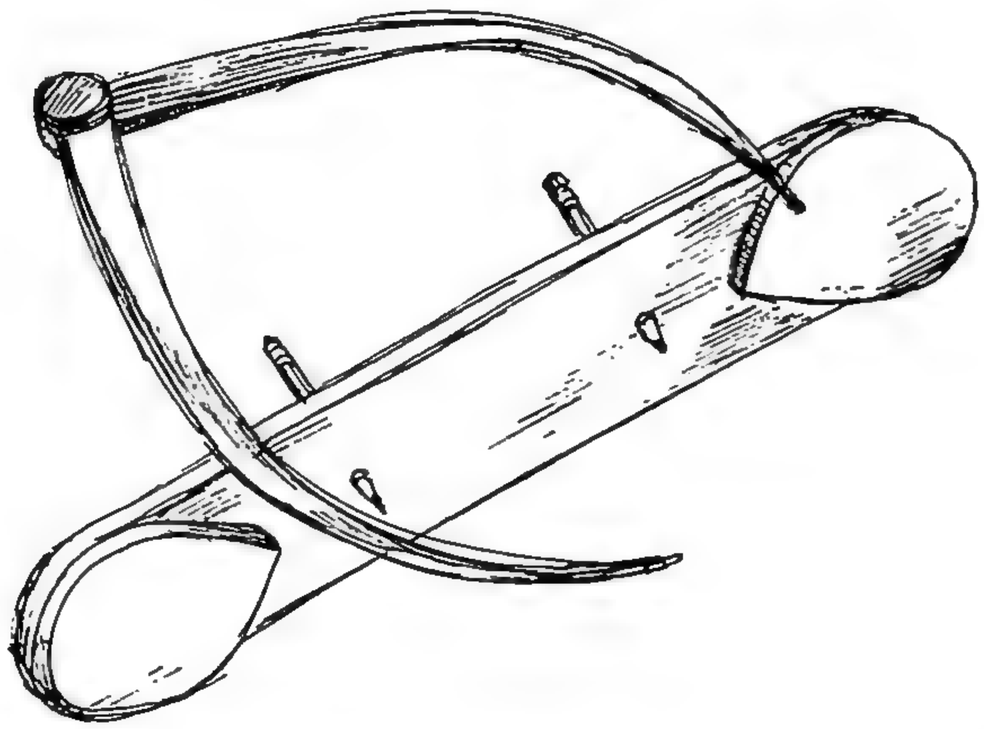
of the timber. From these points on the ends, four lines are run the length of the spar with chalk. These become the reference lines for squaring the spar.

A center head may be used to mark the center of a round spar. It is made by the sparmaker and is used on spars of varying diameters. Two pieces of flat wood are fastened at a 90° angle similar to a square and dovetailed or otherwise made to lie flat. A third piece of wood is then secured between so that one edge bisects the right angle. This piece laps over the two forming the square. The center head is placed flat against the end of the spar, the arms at right angles tangent to the round edges and resting on the edges. A line is struck along the bisecting arm, which passes through the center. Repositioning the center head provides another line and the intersection of the two is the center of the spar.

The diameter of the mast had been determined for several positions—at the step, deck and at three points between deck and crosstrees. These points were found and the diameters marked using the center lines for reference. A square or straight edge was held



Centerhead for finding the center of spars of various diameters

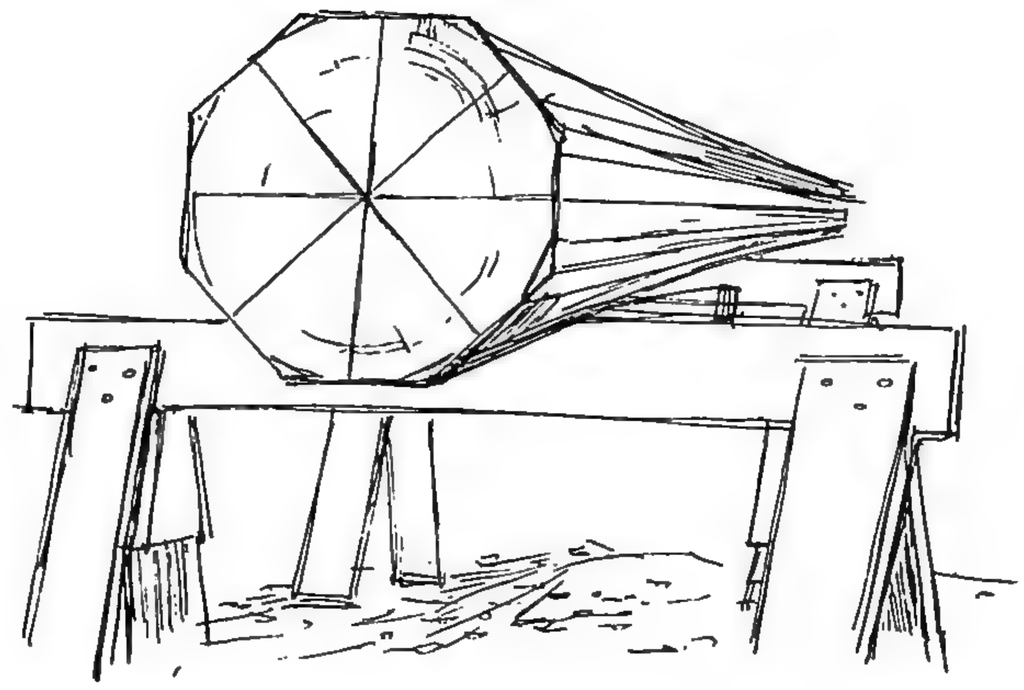


Calipers for measuring the diameter of a spar. Sparmaker's gauge is also shown.

level at right angles to the center line at each station, and the distances were measured out from the center line and projected down on the rounded surface of the spar. Thus the diameters were marked to either side of the center line at the given stations along the mast. These points were then connected with straight lines. In the same manner, lines were drawn to either side of the other three center lines.

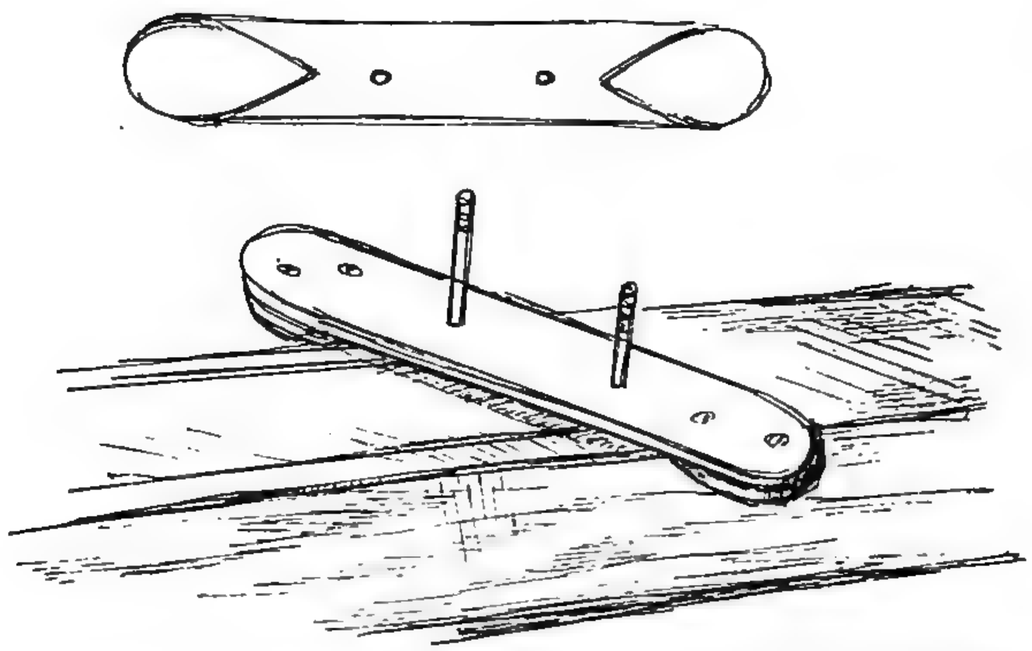
The spar was then planed on each of the four sides producing a squared, tapered timber. A hand-held power planer was used for this work. After each side is planed, the mast is rotated 90°.

On the planed, flat surfaces, new center lines are struck down the length of the mast. These become references for making the spar eight-sided. At the stations where diameters are given, points are marked to either side of the line half the distance of the side of an octagon of that diameter. A scale gives the figure of the measurement, or it may be found by multiplying the radius by a factor of .41. Straight lines are then struck between these points. The procedure is repeated on the other three sides, and the mast is planed to these lines. The mast is made sixteen-sided by the same process, the factor used in this case being .2. Next the spar is rounded by planing off the edges by eye and then sanded.



The mast marked off for planing to sixteen sides

A sparmaker's gauge may be used in place of using the factor and measuring and lining off the spar from a four-sided to an eight-sided timber. It is a time-saver as it automatically adjusts for taper. One gauge may be used on spars of various diameters. The gauge is wood and may be made by the sparmaker. For a spar of 8″ in diameter, the

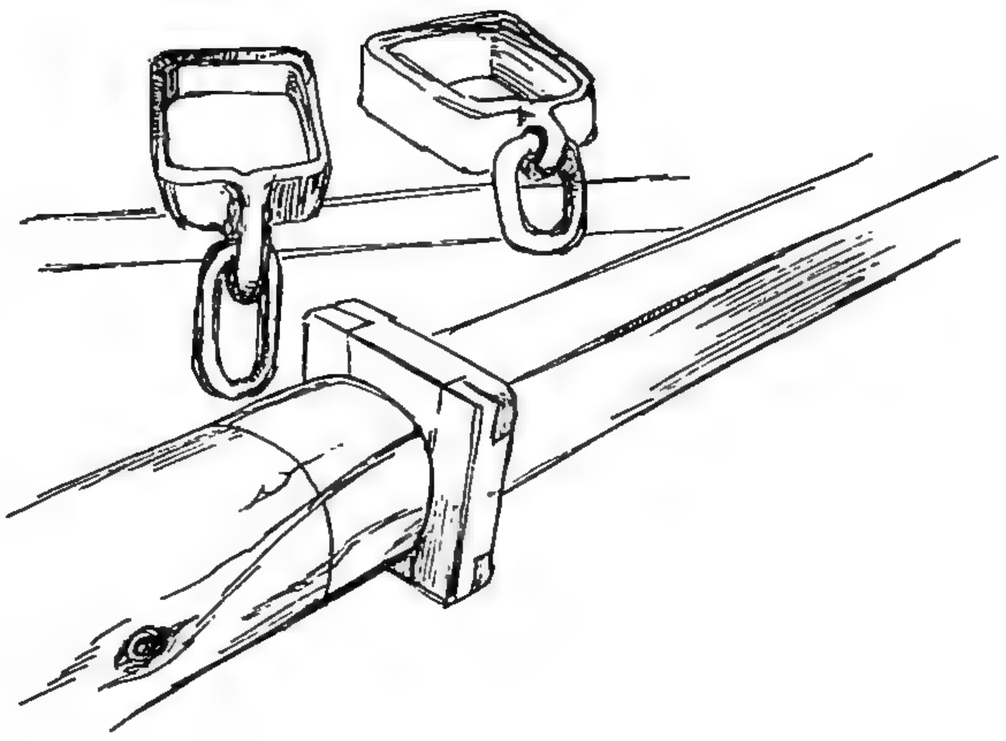


Sparmaker's gauge marks a four-sided timber with lines for cutting it to eight sides. The gauge is cocked as it is run along the spar and, thus, adjusts to the taper.

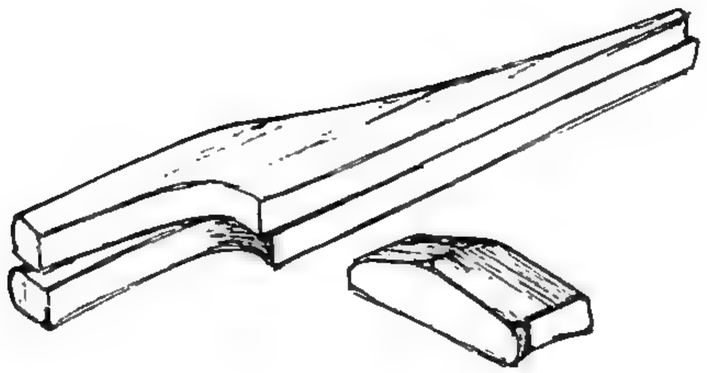
gauge would be made from a piece of wood about 1½′ long and 3½″ wide. On the under side, two guides are fastened, one at each end. Pencil points or metal points project through between the guides, positioned from each guide a distance equal to .293 times the distance between the guides themselves. Thus if the distance between the guides is 12″, the points would be set 3½″ from each. To use, the gauge is held at an angle, guided hard against the edges of the four-sided spar, and pushed along. Two marks are struck on the flat surface of the timber. This operation is repeated on all four sides and the timber planed to the lines to give an octagon cross section.

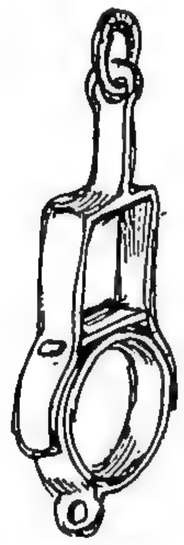
The top 5′ 3″ of the mast is square where the topmast overlaps and a square frame or bolster of oak is fitted where the mast changes from round to square. The shrouds circle the mast on top of the bolster. Iron bands or collars with eyes for the halyard blocks or rings for receiving the topmast are slipped over the tapered, squared section and driven down to the proper height.

After sanding, loose knots were graved

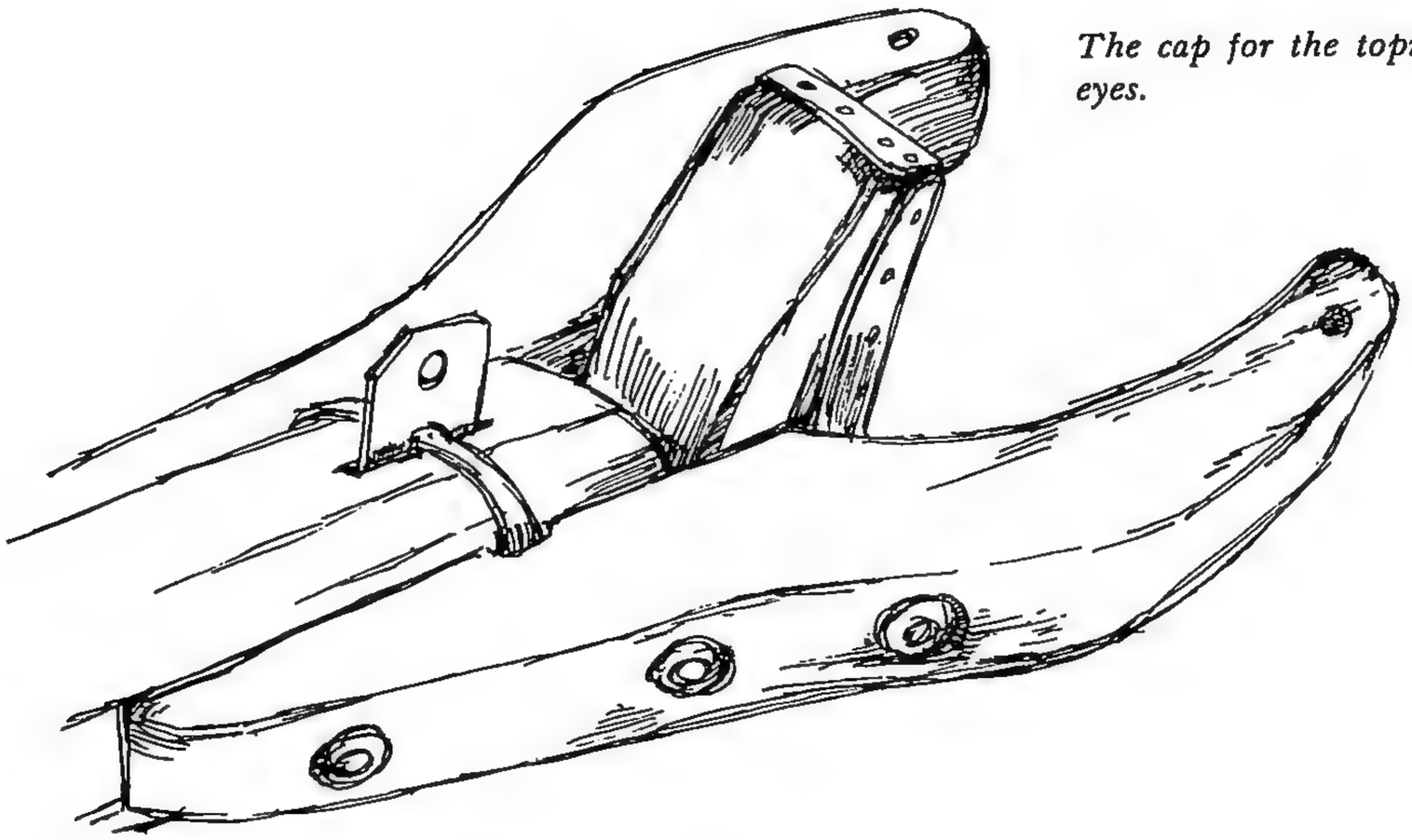


Bolster and bands for halyard blocks





The cap for the topmast. Blocks for halyards attach to eyes.



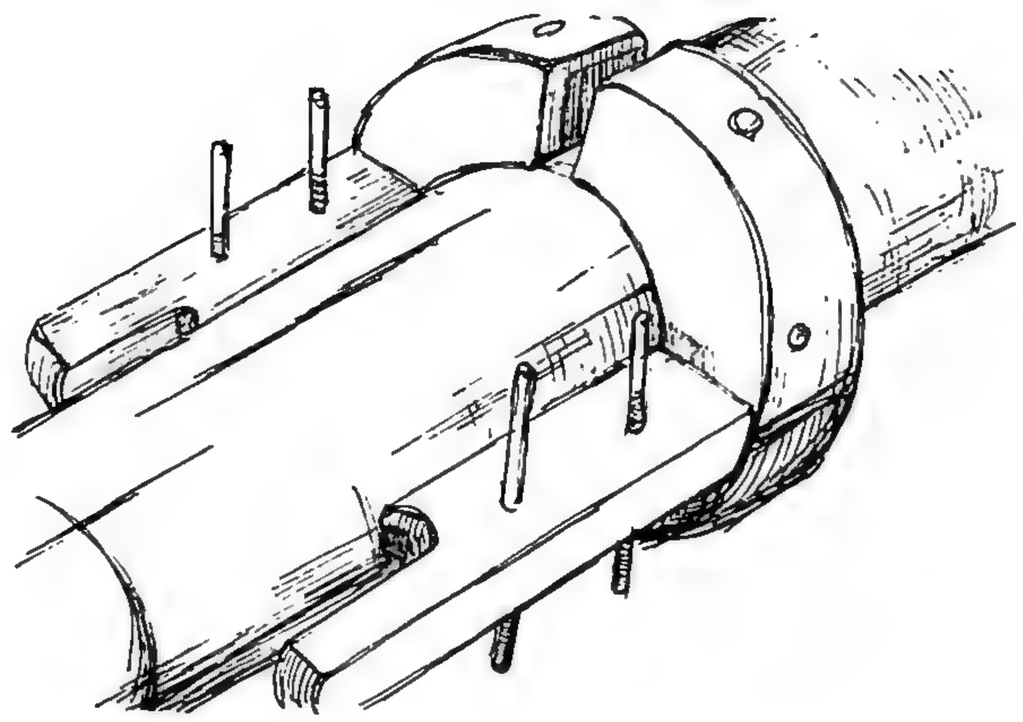
Gaff jaws and tumbler. Jaws are riveted through the gaff. Leather on the tumbler and jaws prevents chafing. New jaws have links of chain for securing the throat block rather than the ironwork shown.

out and the holes filled with wooden plugs set in epoxy. Checks were not filled; however, at the saddle and at the deck, upward-angling stopwaters were bored and driven in checks. The mast was then given a coat of boiled linseed oil and turpentine, 2:1, and the squared top was painted white. The step of the mast was slotted, the cut being 3″ wide and 3″ deep and a band of iron was fitted above the slot for strength.

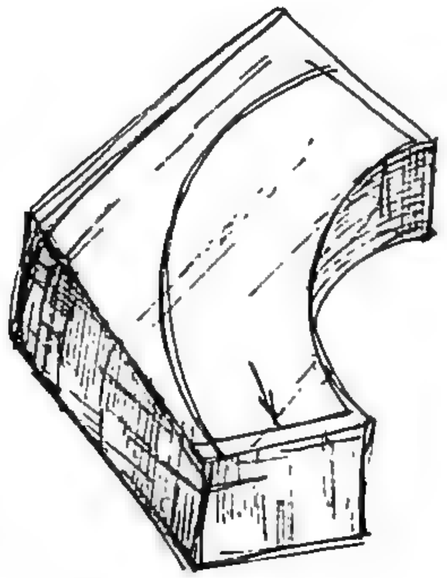
The topmast is 20′ long, tapered from 4″ at the heel to 3″ at the truck. This mast was the main topmast of the *Berry* when she was schooner-rigged. Two cheeks for shrouds are fastened to each side at its head. A sheave is in a mortice at the head for the topsail halyard, and a truck with a small sheave for flag hoists caps the topmast. The topmast is painted white.

The gaff is 23′ long, 4¾″ in diameter at the jaws and 3⅝″ diameter at the end. The jaws are cut from straight-grained oak and are through-fastened to the gaff. A tumbler is held in place between the jaws by a through drift. The bearing surfaces of the tumbler and jaws are covered with leather.

The boom of the *Berry* is 42′ long and



Boom saddle or rest with pins for belaying halyards

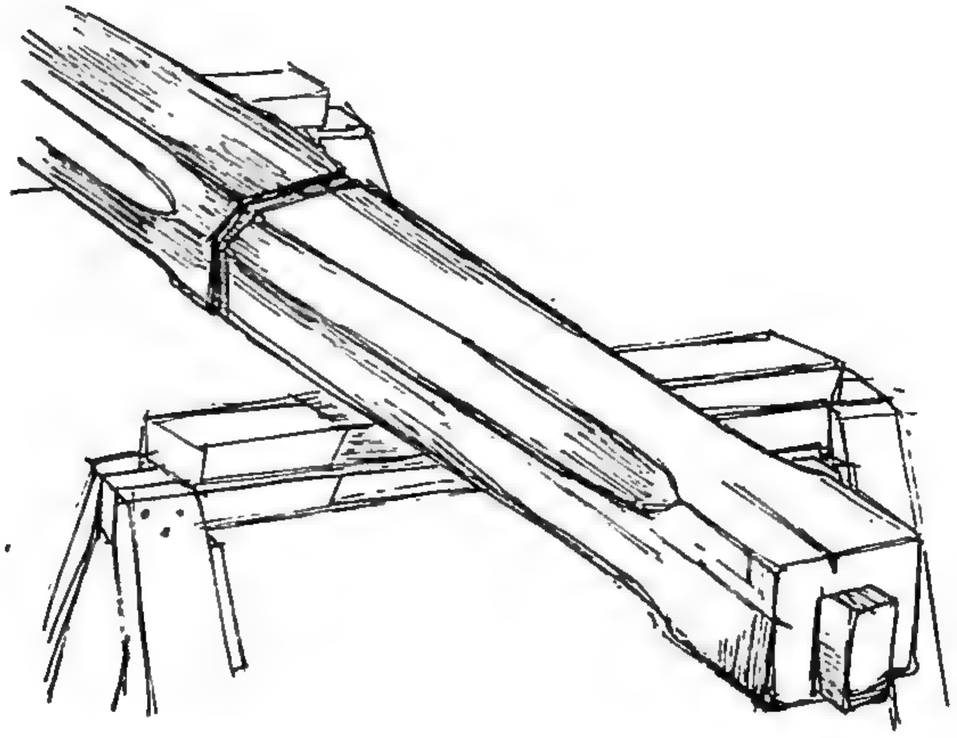


Section of boom saddle before cutting. Wood is white oak.

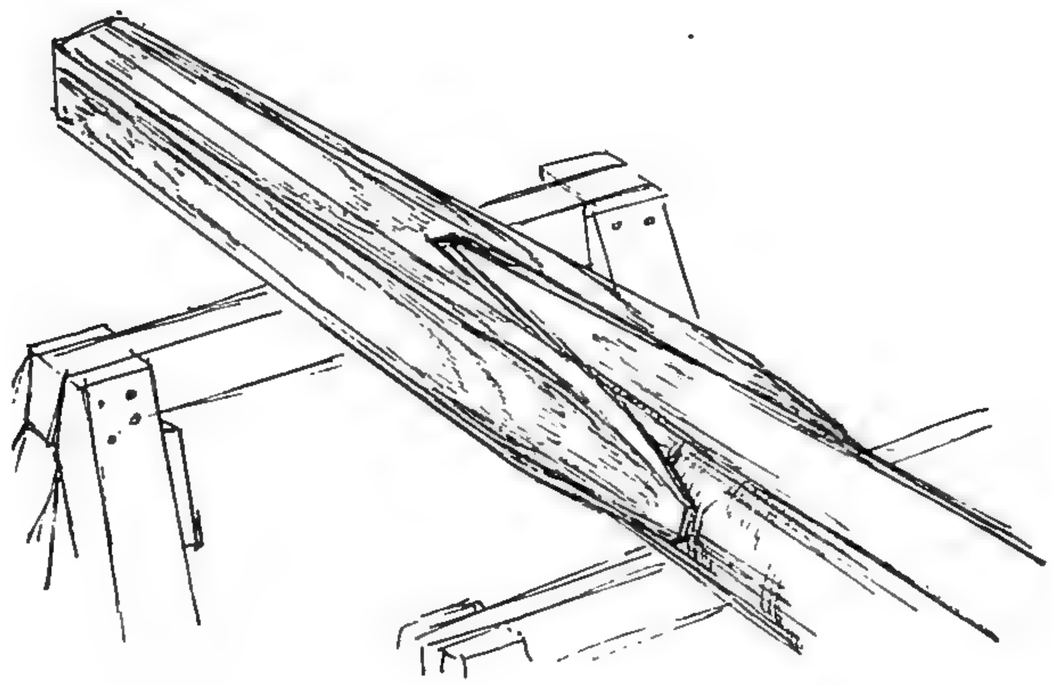
spindle-shaped, the greatest diameter being where the sheet band encircles it. At the inboard end the diameter is 6⅜″; eight and one-half feet from the jaws it is 7⅛″; and at the sheet band it is 8″. From that point to the end—8′—the diameter tapers to 5⅝″. Jaws of oak are secured in the same manner as the gaffs.

The bowsprit projects beyond the stem 18′. At the butt, where morticed into the pawl post, it is 8″ square. For most of the distance from the post to the stem, it is octagonal in cross section; beyond the stem for a distance of 7′ it is sixteen-sided; from there it is rounded. The bowsprit is painted black as far as the billethead and white beyond.

The old yellow pine bowsprit in the *Berry* was too short for a sloop-rigged vessel, so 21½″ were spliced on to produce a final length of 23′ 7″. First the bowsprit was cut back to a point where the diameter was 6¾″. The end was then sawn on the sides to form a wedge 36 9/16″ long, but not thinned out to a fine point, a 1½″ butt end being left. The piece to be spliced, 7′ 7″ overall, was first tapered on two sides at the sawmill: the



Inboard end of the bowsprit. Tenon fits into mortice on the foreward side of the pawl post.



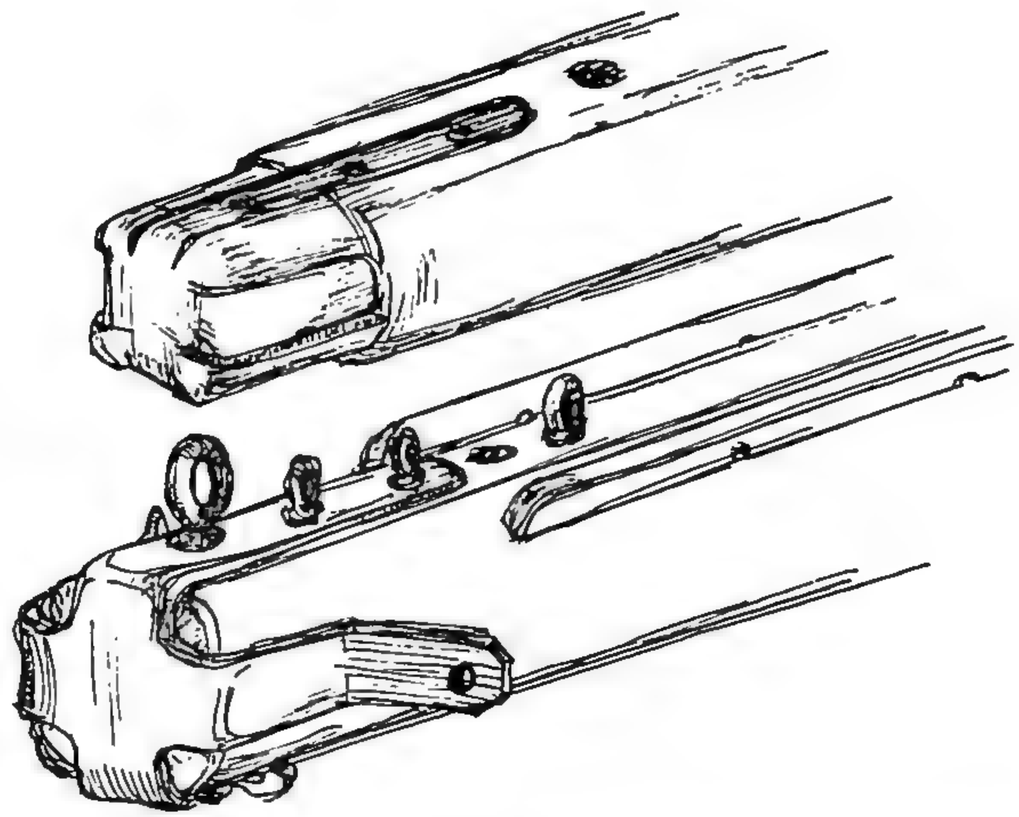
Splice adding to the length of the old bowsprit

timber was placed at an angle on the saw carriage and cut, thus saving considerable shaping by hand. The 3′ notch for the splice was next sawn with a portable circular saw as deeply as possible and then cut through with a hand saw. The apex of the notch was cut to match the butt end of the wedge by drilling holes with a bitt and cutting square with a chisel.

The two pieces, supported on sawhorses, were then placed together, lined up, and saw cut along the joints of the splice until they joined in a tight fit. The pieces were glued with epoxy and clamped. About two square feet of surface was glued in the splice.

The bowsprit is round where spliced. The added piece, four-sided and tapered on two sides, was lined off to give the proper hog and taper to the top and bottom surfaces. The top surface was dropped 7/16″ below a straight taper and the bottom surface dropped 3/8″. The piece was then made eight-sided and finally round in the same manner as the mast.

Batten strips 1 3/8″ high and 1 1/8″ thick were screwed in place along each side, bored at intervals of about 18″ to take jib gaskets. All iron work at the end of the bowsprit for holding forestays and bowsprit shrouds was painted black.



End of the bowsprit showing bee hole for the forestay, eyes for topmast stay, bobstay, and shrouds for bowsprit. Eyes for securing tack of the jib are also shown.

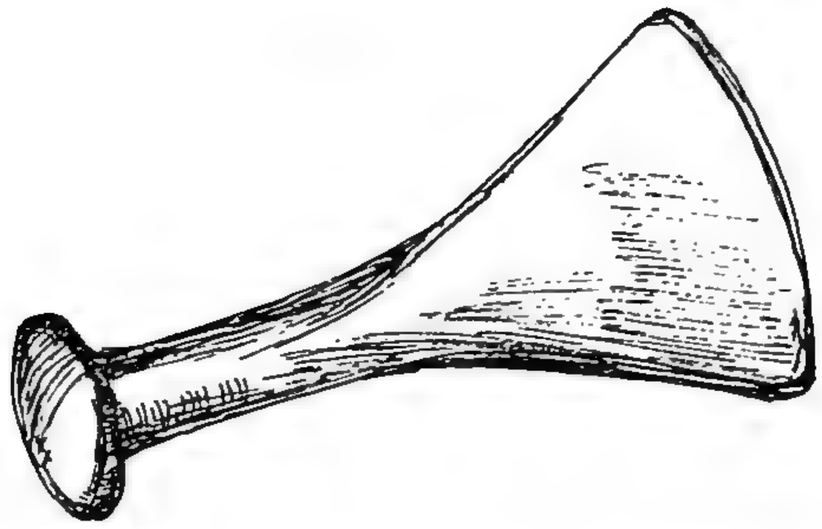
Chapter VIII

MAKING THE HULL TIGHT

A VESSEL is deteriorating from the moment it is built, largely due to the entrance of water. Salt water comes through the seams in the hull and rain water through the deck—the latter is the main cause of rot. Since restoration is concerned with preservation, the problem in all wooden ships or boats is keeping water out.

Leaks below the waterline are along seams, at butts, around fastenings and any hull fittings. Rot, which is caused by fungi, is less common in wood that is always immersed, such as that below the waterline. Fastenings, however, rust and corrode, seams can work, knots may loosen, and caulking may come out. Any of these allows water to enter. The planking of the *Berry* was sound: she had been replanked in the early 1930s with southern cedar planks 1¾" thick. The fastenings used then were galvanized ship spikes. When The Marine Historical Association received her, the fastenings were weak, the butts had been covered with patches of sheet lead, and she leaked. One of the first measures taken by the Seaport shipwrights was to recaulk her. This checked the leaking, but was only a

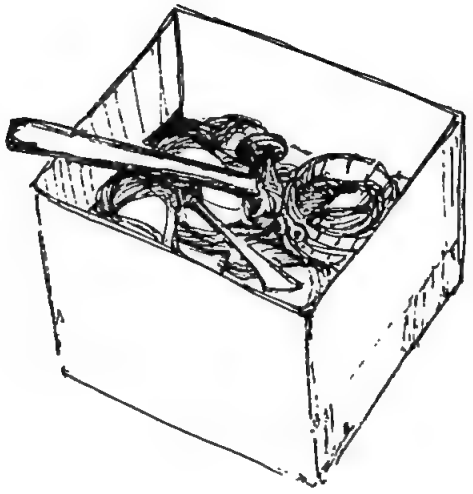
Reefing iron for removing old caulking from a seam. These are sometimes made from old files.



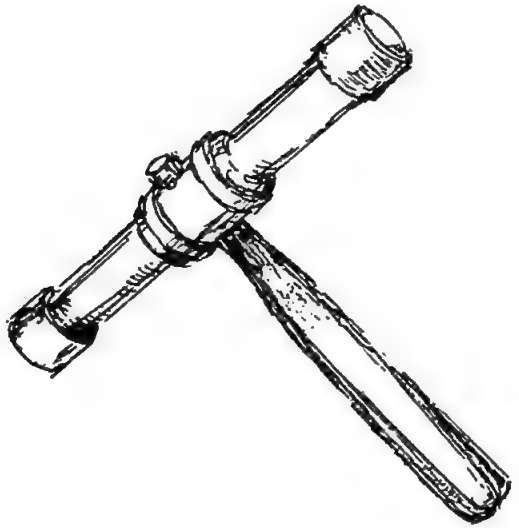
Caulking iron

temporary solution. The *Berry* was made tight only after extensive rebuilding with the replacement of most of her frames and the refastening of the vessel.

When a hull is to be recaulked, old caulking is first removed or reefed out. A reefing hook is hammered into the seam, its handle is levered up, and the hook pries up about an inch of the caulking. This leaves a gaping crack—the caulking seam—which is in depth about one-half to two-thirds the thickness of the plank. The seam was made by planing the edge before the planks were fastened. Ideally the back of the seam should be tight, else the caulking will drive through. The caulker uses irons of various degrees of sharpness: a sharp iron, called a reaming or dumb iron, opens seams in new planking if the seam is too tight. On the *Berry* a strand of cotton was tucked along a seam a foot or more before driving. Tucks, made with a blow on the iron, were spaced closely depending on the openness of the seam. These tucks hold the strand in the seam for the threading iron, which drives the cotton to the bottom. If the seam is wide,



Caulker's box with oakum. The oakum is spun by rolling on the caulker's knees. The strand is then loosely coiled in the box for use.



Caulking mallet. The head is slotted to ease the shock while striking the iron.

more than one strand is used.

The threading iron then drives the strand of cotton to the bottom of the seam. A rope of fiber is formed, compressing the wood on each side of the seam. For the rope to form, or the caulking to be tight, there must be sufficient backing to caulk against as the cotton or oakum is driven with hard blows of the mallet. Depending upon the size of the seam, one or two strands of cotton are followed by a strand of oakum. A making iron, an iron with a blunt edge, is used at this point. These irons may have one or two grooves in the edge: the bluntest, with two grooves, is used in the widest seams.

When properly done, caulking stiffens a vessel as well as making it tight. As the planking swells after it is wet, it becomes much stronger and tighter. Caulking may also improve the appearance of a boat with uneven seams. If the seams are of unequal width, by heavily caulking the tighter ones, the open ones will tend to wedge together, as the irons can set the planks edgewise. Open seams are commonly caulked last. As the other seams are caulked, the open ones close. The garboard seam of the *Berry* was

last to be caulked. Following the caulking of the vessel, the seams were filled with putty or a seam compound.

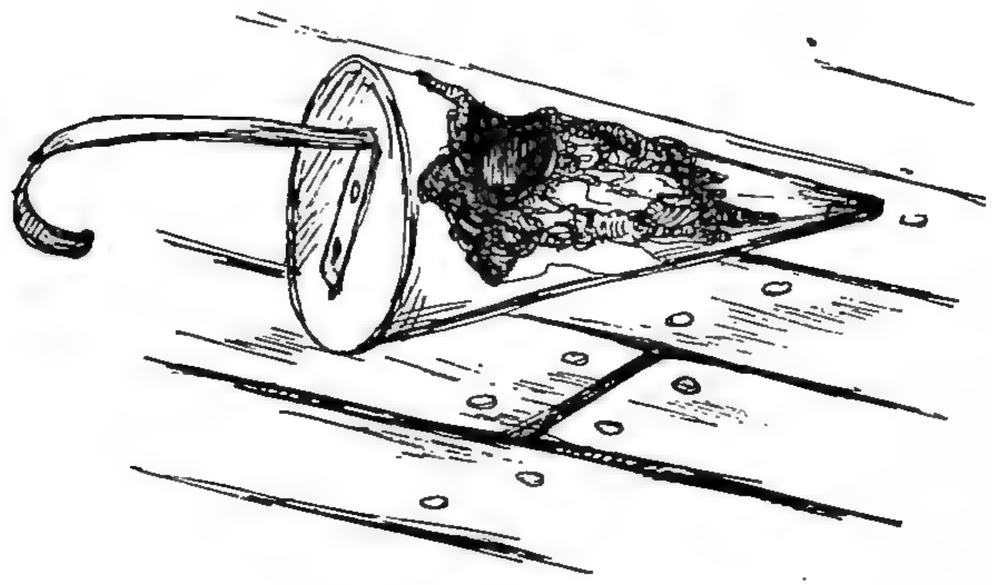
The *Berry* was restored under a plastic-covered shed and as she lay there for over a year and one-half, there was some drying. Seams opened as planks shrank, but a year after the boat had been hauled, a scraper still revealed wet wood under the bottom paint. Those seams that did open and promised difficulties for the caulker were covered with battens on the inside before the boat was ceiled. The battens were made of oak, 1½" thick, laid in white lead along the seams between the frames. They were 3" wide and were fastened from the outside with screws on each side of the seam. A space was left between the batten and the frames to act as a waterway so that water would not stand on the top of the block. Opened seams were thus given backing for tight caulking.

As rotted frames and butt blocks came out of the *Berry,* new openings were made in the planking. The ship spikes were driven out and the holes plugged with cedar and bunged. Butts sometimes landed on frames and sometimes between. The holes left by the fastenings, particularly those above the waterline, were enlarged by rotting and at some butts, splintering, as the spikes were backed out. Dutchmen—patches of cedar shaped to fit—were fitted into the gaps and irregular holes. These were glued with epoxy and screwed. Oak butt blocks about 10" long set in white lead were put over the butts in the bays between the frames. These blocks, 1½" thick, lapped the planks by ½" above and below. Three-inch No. 16 bronze screws fastened the ends of the planks to the block. When the butt landed on a frame, the three fastenings in the end of each plank entered the frame. The opening at a butt was often ½" wide, but with the block or a frame as backing, it could be caulked.

Occasionally, rotten loose knots were found. These were drilled or graved out and a cedar plug set in epoxy driven into the hole. The hull beneath the waterline was checked repeatedly, inside and out, for unplugged openings. She was entirely recaulked below the waterline before being put back into the water after the major restoration to the hull.

Decks of vessels are also difficult to keep

tight. They are cut for openings such as hatches and companionways. Various timbers—bitts, stanchions and posts—pierce the deck, and leaks are common around masts and deck houses. The wood topside is wetted by rain and spray, and fresh water often stands at low points on the deck, to work into seams and joints. These seldom really dry in summer and they freeze in winter. Fresh water is more damaging than salt because the molds that are responsible for decay are inhibited by salt. For these reasons open seams and rot on deck are common. Rotted deck beams, clamps and partners beneath follow.



Can for applying pitch or tar to deck seams. The pitch is heated before pouring.

On the *Berry* all of the rotted timber was replaced. Seams in the new decking were caulked in the same manner as the hull planking with cotton and oakum, with pitch or tar substituted for putty. The former is poured into the seam hot. Where covering boards butted, stopwaters were used, principally to prevent leaking but also to coke, or prevent the planks from curling up at the joints. Stanchions were pined where they passed through the deck, and bitts were caulked. Scuppers pierced the bulwarks at the stanchions in the waist of the vessel. These, with the 3″ crown of the deck, keep water from standing on deck and eventually seeping into seams. Finally the painting and oiling applied to the topsides check the entrance of water.

The wet well presented particular problems for the watertight integrity of the *Berry*. Its bulkheads are built around frames and the keelson. Stopwaters on the sides of each frame and the keelson, and caulking on the tops of the timbers and between the timbers of the well itself made it tight. Caulking, of course, was done from inside the well.

Chapter IX

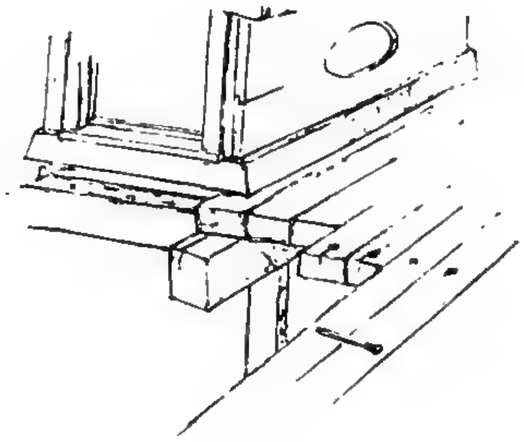
WET WELL

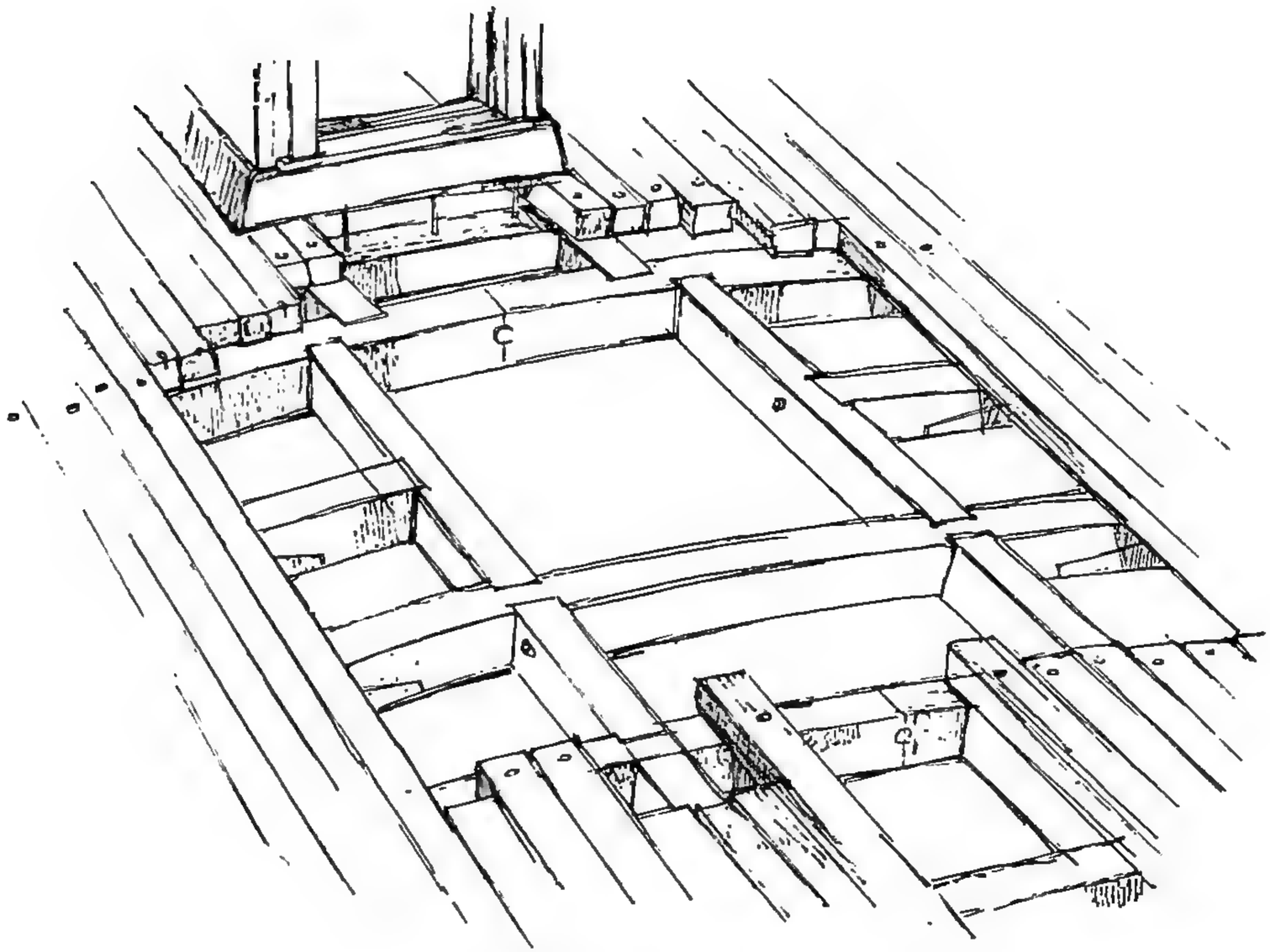
THE *Berry* originally had a wet well amidships for carrying the catch—fish and later lobsters—live to market, but this was removed during reconstruction in the 1920s to make space for cargo. We built a new well into the boat as a part of her reconstruction as a well smack.

The size and shape of the well were established by study of old plans and drawings, from correspondence with a former owner who had removed the original well, and with the advice of Mr. Chapelle. Its general shape is a pyramid with the apex cut off at the deck. The foreward and after bulkheads are vertical for two feet before sloping inwards. The opening in the deck is flush, without coamings, in order that the catch on deck can be quickly shoved in. At the deck the well is 36″ x 40″: at the bottom, 7′ x 7′. Water enters through holes bored in the planking and fills the well to a depth of about 3½′ at the deepest point in the middle.

The *Berry*'s hatch had been made larger in the 1920s for easier cargo handling. As a part of the restoration, the opening was made smaller to fit the top of the well. A second, smaller hatch giving access to the

Deck planking aft of the companionway removed. Two smaller hatches, one to the fish well, replace the single large hatch to the hold.



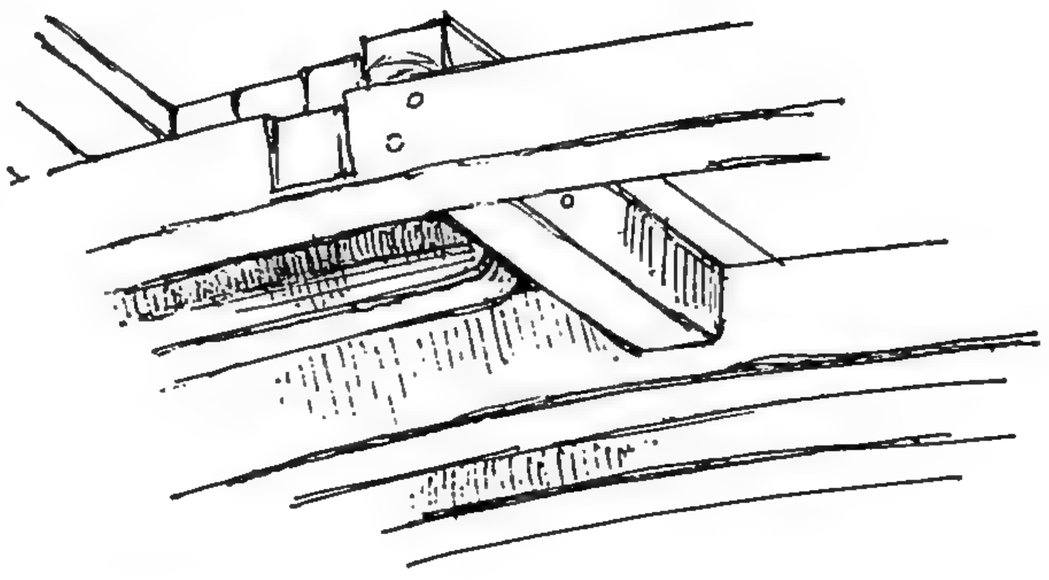


Deck beam and deck frame reconstruction. The entrance to the well is in the center of the illustration. A small hatch to the spaces around the well is in the right foreground.

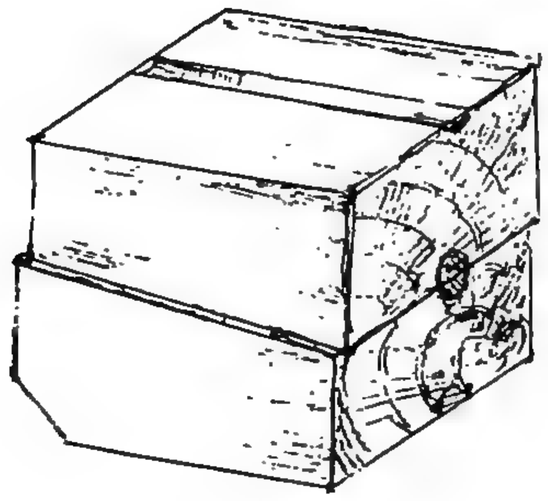
space around the well was made aft of it. This required tearing out the decking from the foreward companionway to the deckhouse and removing the old coamings and carlings. Scarf ends were cut on the deck beams and extensions spliced on the ends. These joints were glued with epoxy and bolted. A new, full deck beam was placed at the foreward end of the opening to the well. All beams were white oak, 3″ x 4½″; carlings were 4¼″ x 3¾″. Tapered notches were cut and the ends of the carlings were let down into the deck beams. In the same manner, deck beams were let into the carlings where they butted against them. Drifts or screws fastened carlings and beams; ends of the drifts were plugged with bungs.

The well installed at the Seaport was built into the vessel around existing floors, frames and keelson, which made the task of fitting the timbers and securing a tight seam difficult. Uneven surfaces on the planking, keelson and frames, and frames which were not at right angles to the centerline, were some of the difficulties: since the sea has free access to the well, strong, tight construction is essential. Heavy timbers were used in building, and stopwaters were placed wherever needed.

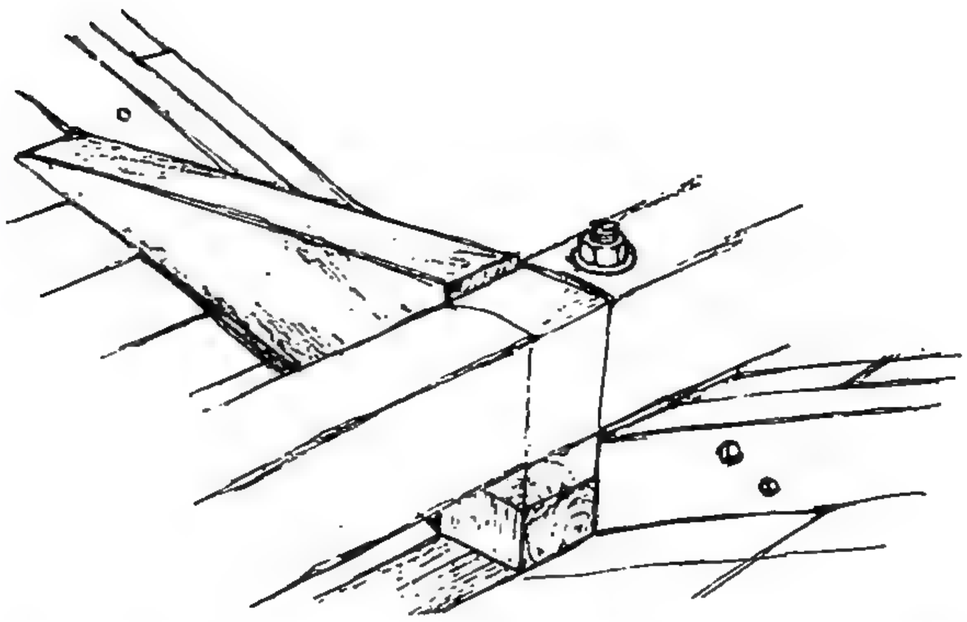
All surfaces were first dubbed fair and smooth with chisels and planes. This included tops of frames, and tops, sides and bottom of the keelson where the well bulkheads were pierced by these timbers. Blocks of yellow pine were then fitted under the keelson at each end of the well. Each was made of two wedge-shaped parts, 4″ wide. Half-round grooves were cut in the tops and bottoms of the blocks and half-round stopwaters of cedar were placed in the grooves



Carlings are notched into the deck beams and secured with drifts or toenailed from the side.



Stopwaters were placed between the blocks driven under the keelson.

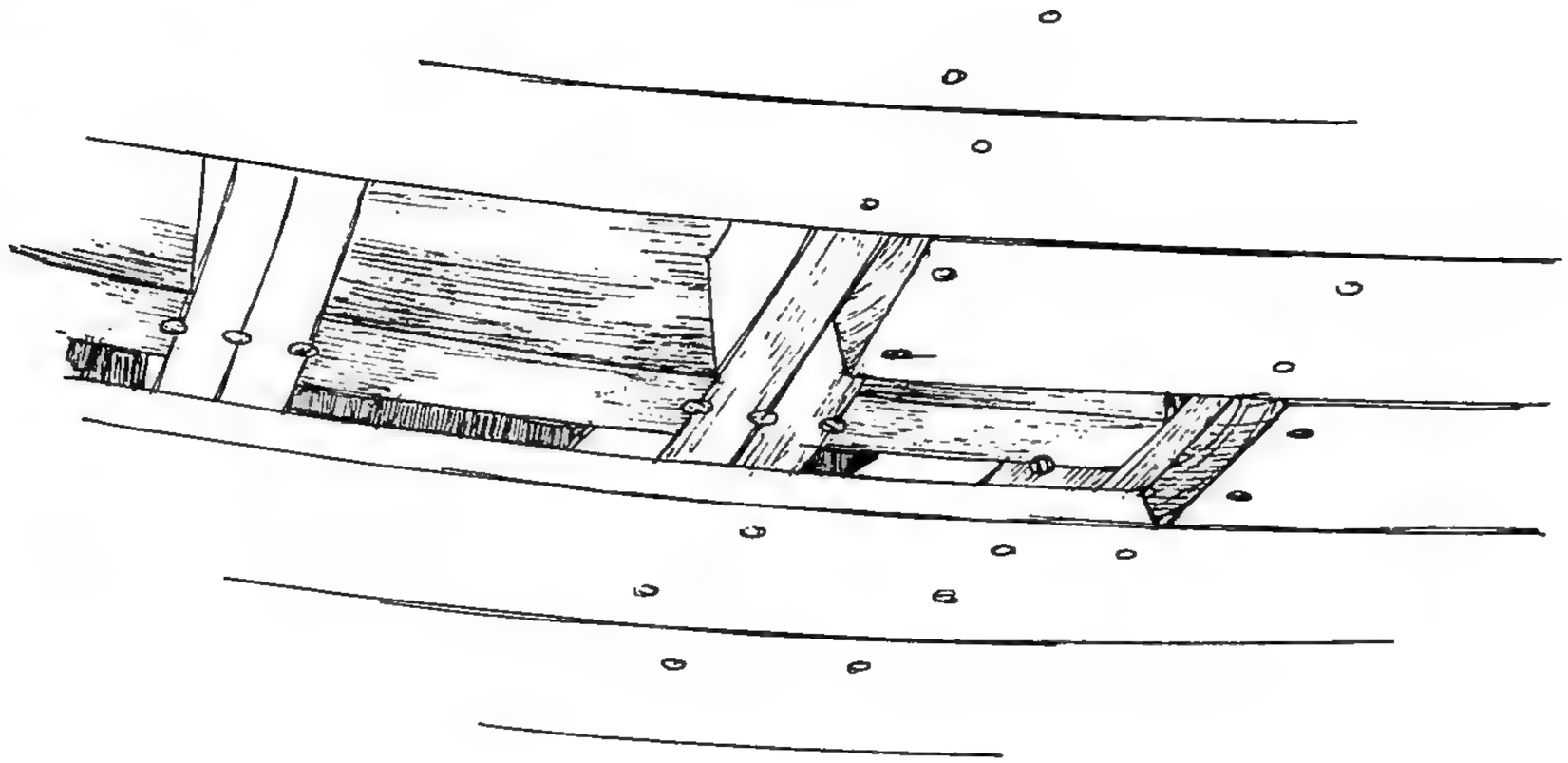


Oak timbers to either side of the keelson form the foundations for the end bulkheads of the well. These were secured with bolts to the frames behind.

before the two wedges were driven together from opposite sides under the keelson. When wet, the soft cedar swells and closes the seam. A hole was bored between the wedges to take the cedar stopwater.

Wedge-shaped timbers of white oak, 4″ thick, 12″ deep and 30″ long, were then placed on either side of the keelson at each end of the well. These formed the foundations of the end bulkheads. They lay against, and were bolted to, frames in the manner of floor timbers; where necessary, shims were placed between the timbers and the frames. A caulking seam was cut on the under surface before placing the pieces, to permit caulking on the inside of the well between the planking and the underside of the bulkhead. To prevent leaking between the keelson and the blocks beneath and the wedge-shaped pieces to either side, stopwaters ¾″ thick were put in down the seam. These stopwaters, reaching 12″ to the top of the keel, also served to coke or hold the pieces in line.

Frames passed through the well, so the bedlogs of 4″ oak were notched to fit over them. These formed the foundations for the

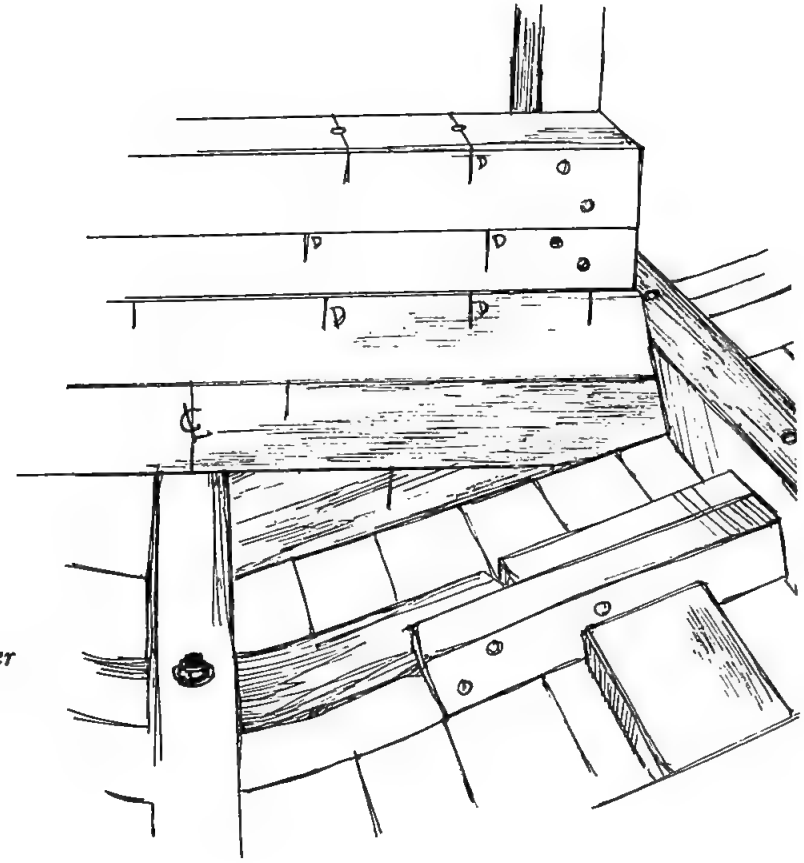


Planks were removed in way of well ledges. Illustration shows stopwaters to either side of frames and through the middle of doubled frames.

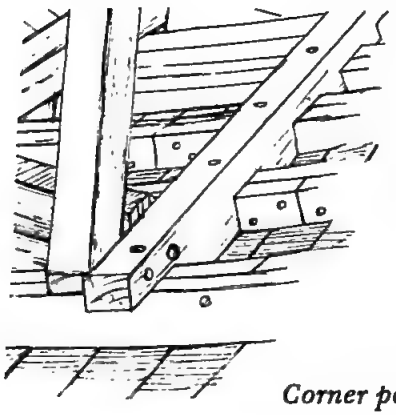
side bulkheads. The seams between these timbers and the frames, as well as the seams on the underside against the planking, also had to be tight. Since the cedar planking was worn and uneven, and a tightly caulked seam would be difficult, it was decided to remove the planking in the way of the bedlogs, fit the bedlogs, and after dubbing the under surfaces fair and cutting a caulking seam on the inside, fit new planks.

A pattern was made showing the positions of the frames, and the angles between the frames and bedlogs were measured. The timber was then cut and fitted over the frames. Stopwaters were made on each side of each frame and through the middle of the doubled frames. The top surfaces of the frames were caulked. The bottom planks were then fitted and fastened with 3½" No. 16 bronze screws.

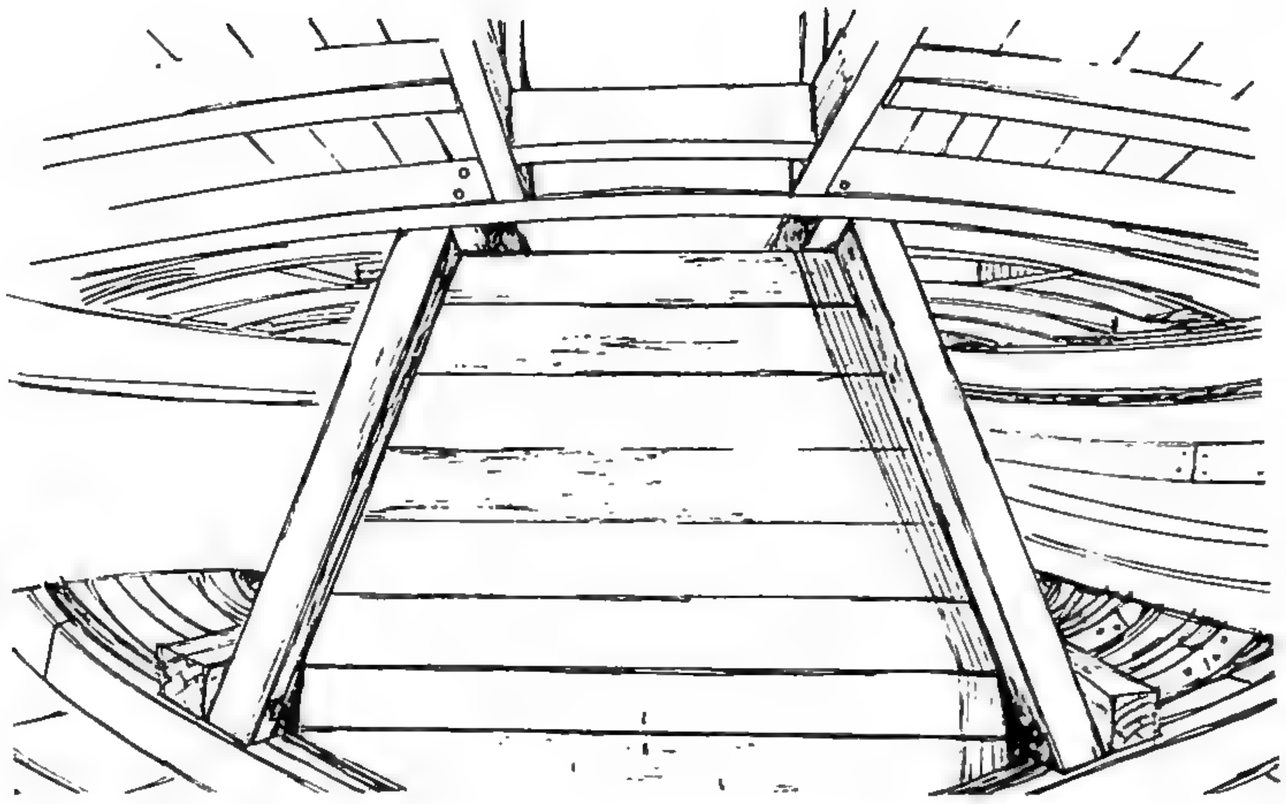
The end bulkheads were built up with 4"-thick oak timbers until level with the bedlogs. Galvanized, wrought iron drifts edge-fastened the bulkheads. At each corner of the well an oak timber was set up to act as a corner post. These rested on frames at the



Bulkheads were built up of oak timbers drifted together



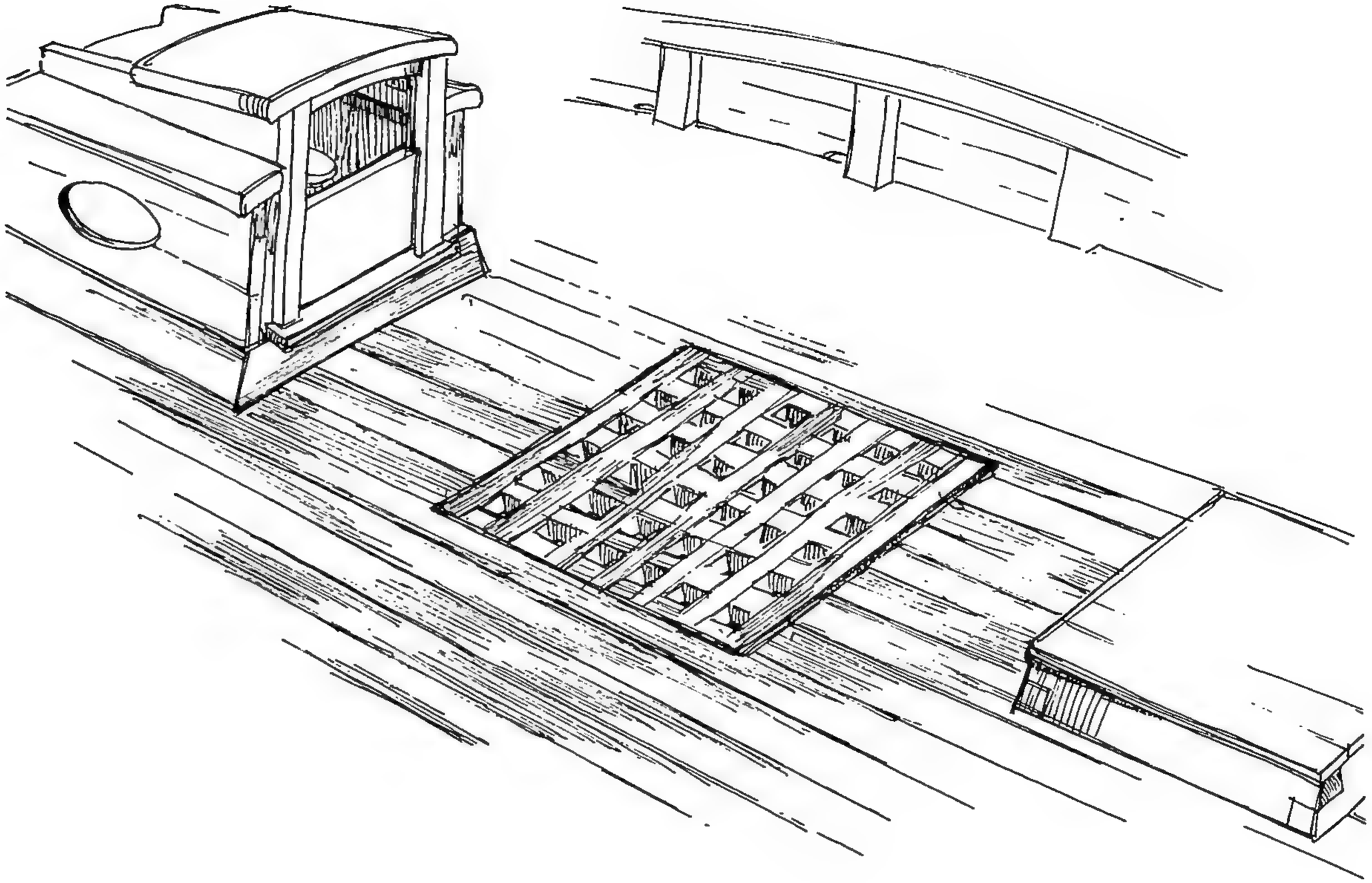
Corner posts of well



Foreward bulkhead. Sides have not been built up on the side ledges.

bottom and angled upward to be notched and bolted into the carlings at the top. As the sides of the well were built up, the ends of the timbers were bolted with ½" drifts into the corner posts, three to a timber. Bungs plugged the ends of the drifts. Pine timbers 3" wide were used to build up the sides on top of the oak bedlogs, and these timbers were drifted together in the same manner as the oak foundations with ½" iron drifts spaced about 14" apart. Caulking seams were planed on the edges. The pine planking was built up to the deck opening and a covering was made.

After the bulkheads were completed, the seams were caulked from inside in the same manner as the hull planking. The inside of the well was given three coats of anti-fouling paint, and a hole was bored in the planking to admit the water. A wet well in use would have many holes to provide proper circulation to keep the catch alive—these would be bored and the inside edges painted before launching. Since the *Berry*'s well is not expected to be put to use for keeping fish, one hole only was bored to flood the well.



White pine grating over the well. Size opening 36" x 40".

Chapter X

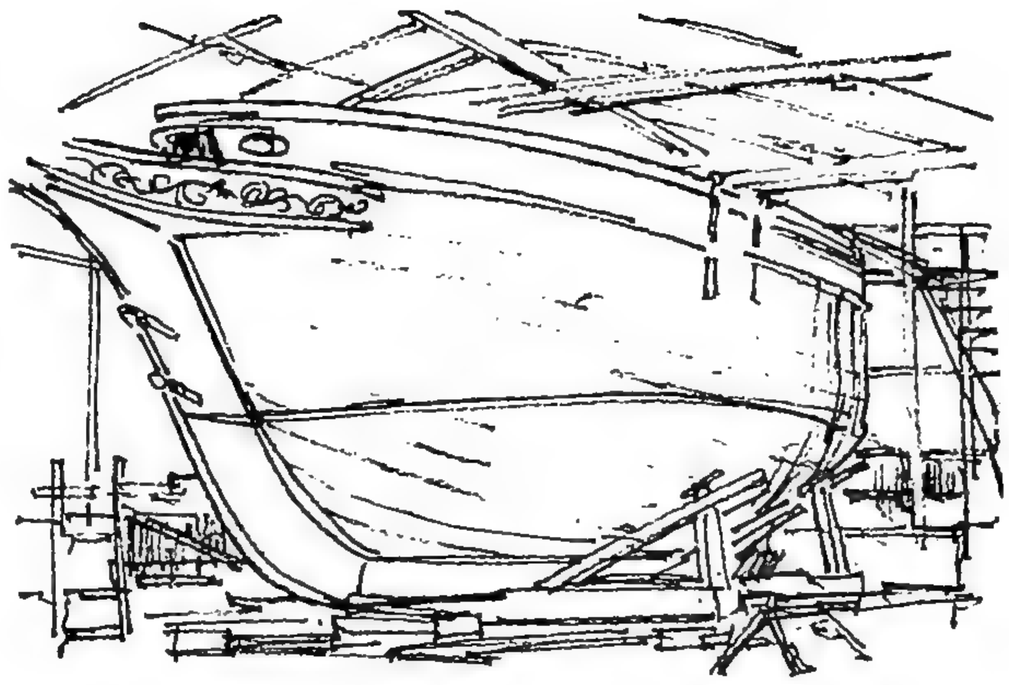
PAINTING AND DECORATION

In the 1860s as they do now, fishing vessels had varied schemes for painting and decoration. Cost, available paints, preservative qualities, conventions, and the whims and taste of the owner influenced the choice. Certain conventions were observed fairly generally, however, and we know of these from painted models, photographs, written descriptions and paintings. The painting schemes were conservative and changed slowly, and craft of different types often had the same general plan and choice of colors. Thus schooners of the 1880s and after were painted much the same as th Noank sloops of the 1860s. The forest gree paint for sides has been standard in New England fishing vessels for a century or more and is still popular in draggers.

The *Berry*'s rail is bronze or forest green, the same paint as the sides. The cap, topping the bulwarks, runs without a break along the sides and across the stern. Its top surface and inside and outside edges are green. The bulwarks below the cap are a light gray inside; these meet the gray covering boards on the deck. The outside of the bulwarks are black, making a broad dark stripe along the

hull. Under it, a narrow, yellow bead 1¾" wide is between the bulwarks and the green sides. This is the outside edge of the covering boards where they lie on top of the sheer strake and runs from the stern to the bow, where the line is continued along the top edge of the trailboards out to the billethead. The yellow stripe gives emphasis to the sheer of the vessel. Topsides are forest green. There is no boot topping; the red bottom paint and the green of the sides meet at the waterline, marked by a groove cut into the planking. The old waterline was retained.

In preparation for painting, topsides were taken down to bare wood, or wooded; bungs, seams and butts were faired and smoothed with planes, hook scrapers, vibrator sanders and hand sanding. One coat of paint was then applied, care being taken to paint the insides of all seams, which were then filled with white lead putty. The putty must follow the first coat: otherwise, the linseed oil of the putty is drawn into the bare wood and the dried putty falls out. Two more coats of the forest green were brushed on. The paint is a standard, oil-based marine type. (Below the waterline the hull was wooded, the paint

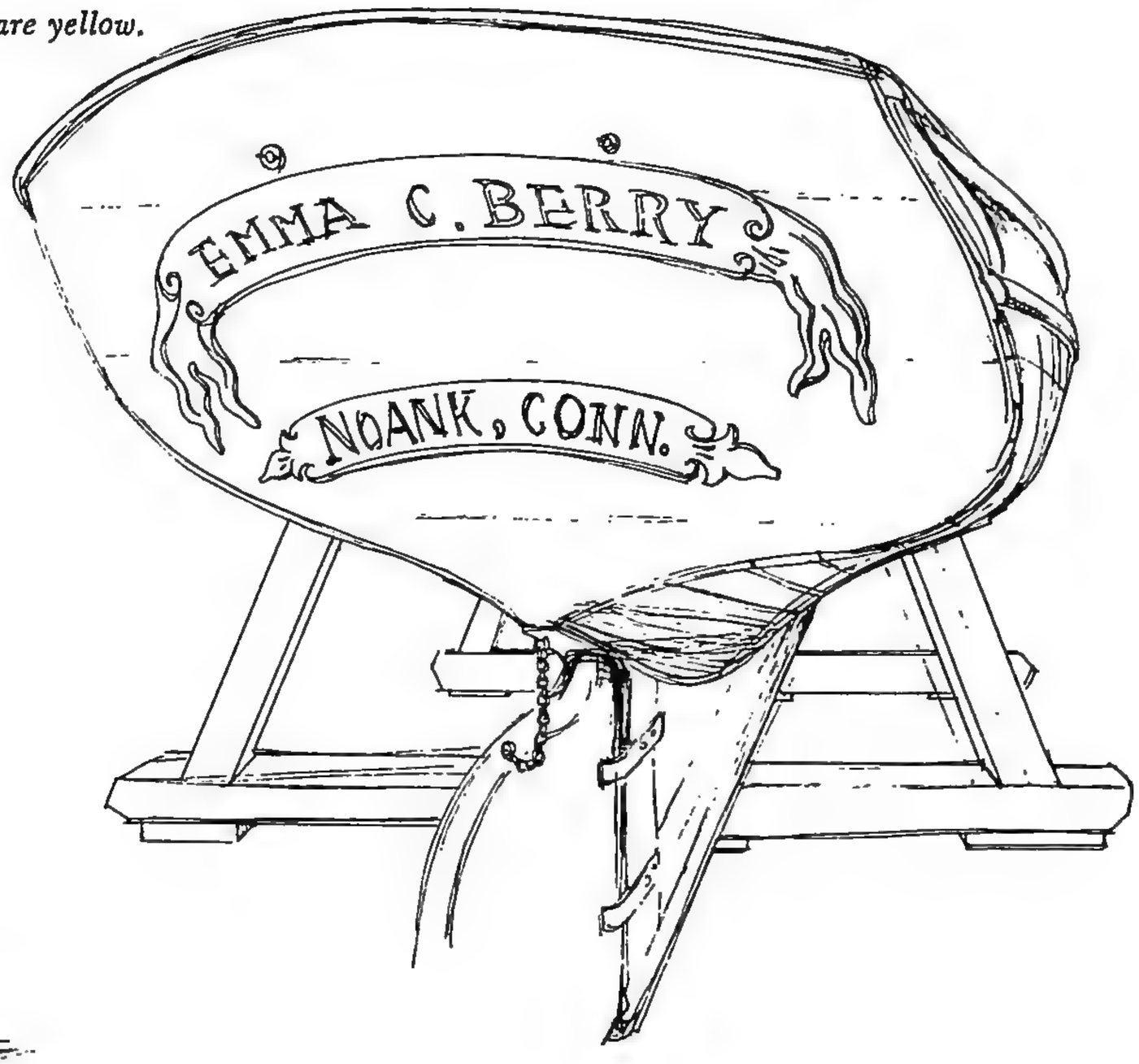


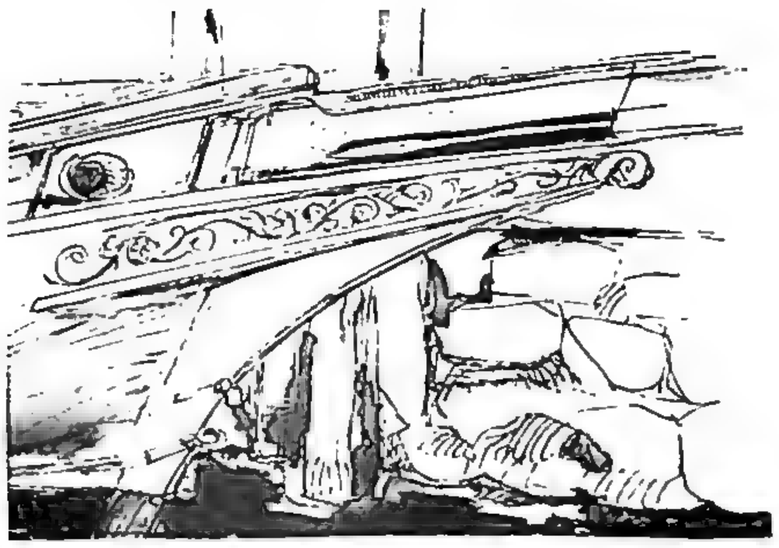
Rail is forest green; bulwarks black. A narrow yellow stripe divides the bulwarks and the green sides. Bottom is red copper anti-fouling paint.

burned and scraped off.) All surfaces, including the inside of the fish well, were given three coats of anti-fouling paint. The seams underwater were filled with a non-hardening compound which was worked in on top of the oakum after the first coat of anti-fouling paint. The final coat was applied shortly before the vessel was launched.

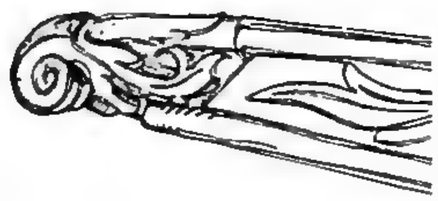
The *Berry*'s deck is oiled with a mixture of one gallon boiled linseed oil to one pint

The lettering and outline of the nameboards are yellow. Background is forest green.





Carved trailboards of the Berry. *The leaves and trim are yellow against a forest green background.*



Billethead is painted yellow

pine tar to one pint turpentine. This was applied twice. Bitts for windlass, mooring bitts and pawl post were painted the same gray as the insides of the bulwarks. The king plank is also gray, as are the covering boards. The tops of companionway, deck house and wheel box are gray, while the sides of these structures are forest green. Hatch coamings are green, the hatches themselves gray. Most of the ironwork around the deck is black; this includes chain plates, deadeyes, windlass mechanism—although the pivoting lever is white—and the main sheet traveler. The jib traveler, which is wood and goes across the deck from bulwark to bulwark, is oiled.

The carved decorative work on the *Berry* —the trailboards, name boards and billethead—has yellow trim against a green background. The name board on the transom, carved to represent a banner, came with the *Berry;* the hailboard was made at the Seaport. The billethead, a scroll, was restored, as were the old trailboards with their leaf motifs. Thin pieces of wood were glued and screwed to the back to give strength to the trailboards, and holes and cracks were filled with epoxy.

Below, after caulking and puttying, the ceiling was then painted out with two coats of light gray. The floorboards in the after cabin and forecastle are gray. The inside of the planking of the hull and the frames is unpainted, but treated with pentachlorophenol preservative. The ends of stanchions, the sheer strake and the spliced ends of deck beams were given a coat of red lead. (Old deck beams and the underside of deck planking had been painted out white in the past.)

The mast of the *Berry* from the heel to a point a foot below the hounds is oiled with a mixture of boiled linseed oil and turpentine. This dries in a tough coat and with age and more applications darkens almost to black. A white band circles the mast at the boom jaws and saddle. At the top, the doubling and all ironwork, which includes the spreaders and bands, is white. The topmast also is white as is the boom and gaff, with three coats—two flat undercoat layers and one of semigloss. The bowsprit is black at the inboard end, but white from the billethead outboard, while the ironwork at the end is black.

Chapter XI

STANDING AND RUNNING RIGGING

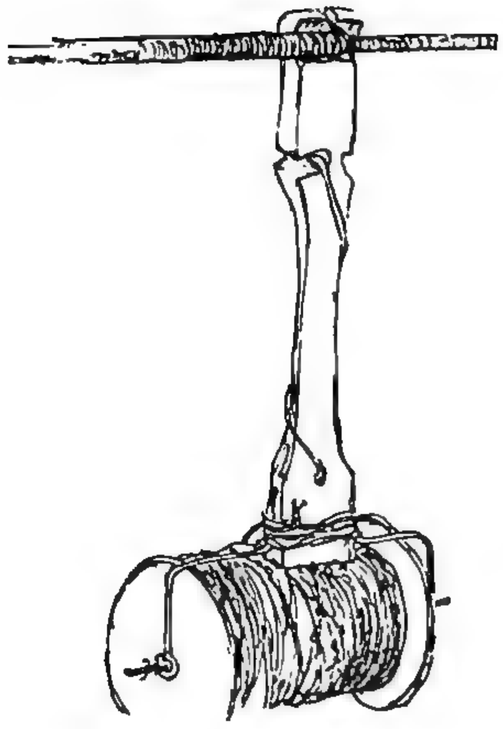
THE *Berry* has the following standing rigging: lower shrouds and forestay, topmast shrouds, topmast forestay, bowsprit shrouds. Running rigging consists of halyards and sheets of Manila line. But for the bobstay, which is chain, the standing rigging is six-strand, galvanized plow-steel wire. The topmast stays are 3/8" wire; all the rest is 5/8".

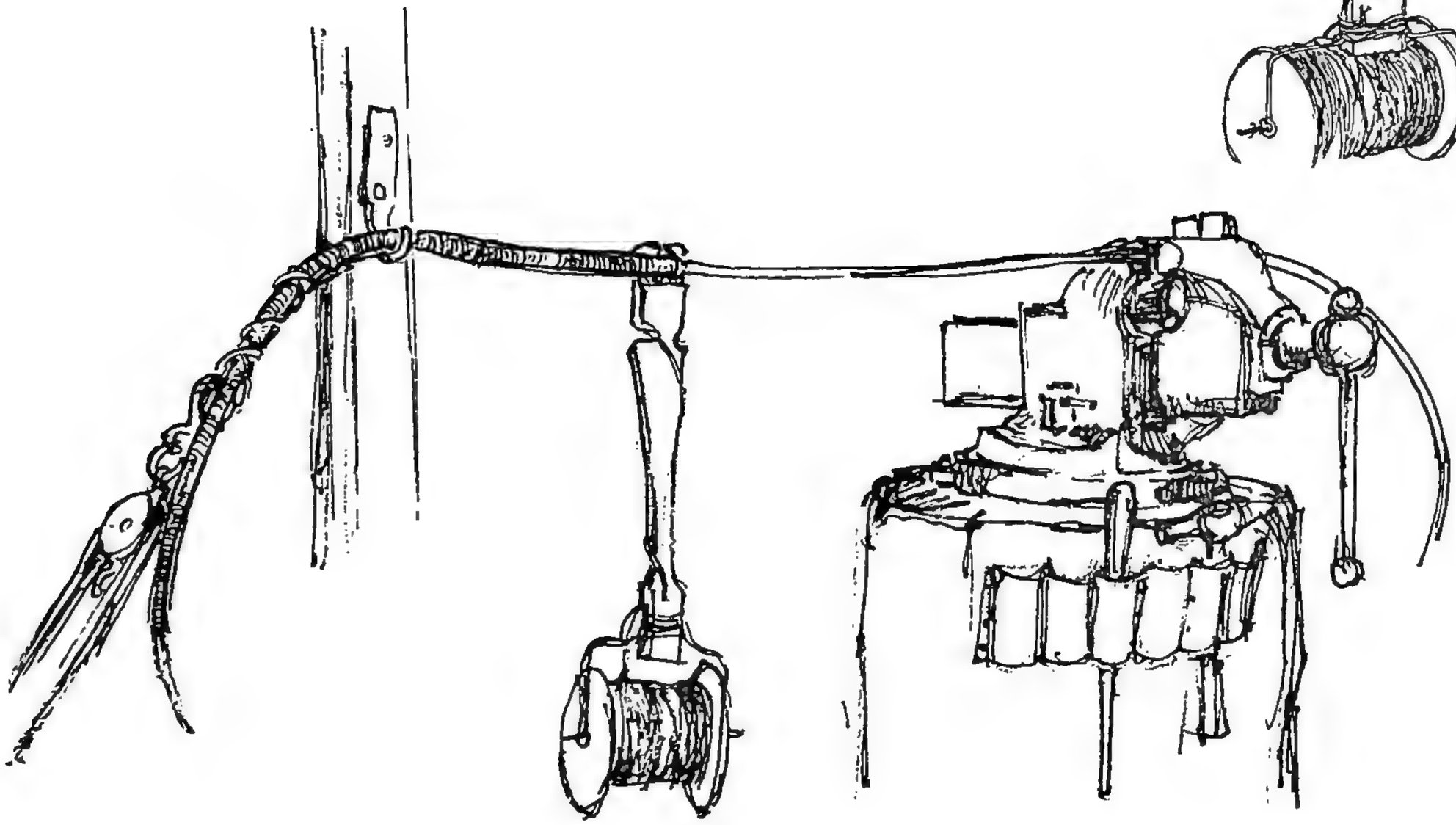
The lower shrouds run from a deadeye up the mast to the hounds, where they circle the mast on top of the bolster, and down the same side to a second deadeye. Each pair, port and starboard, is seized together after circling the mast: thus, if one parts, both are not lost. The total length of the port shroud is 82′; that of the starboard, 82′ 2″. The extra length is because one lies on top of the other as they cross on top of the bolster.

The shrouds are served their entire length with one layer of serving; at the hounds there are two layers. Serving—wrapping the wire with protective layers of canvas and fiber—is a means of preservation and, in some cases, protection against chafing. Also seizing line will not slip on served wire.

In serving, a base preservative is first ap-

A serving board. A serving mallet or board may be used.



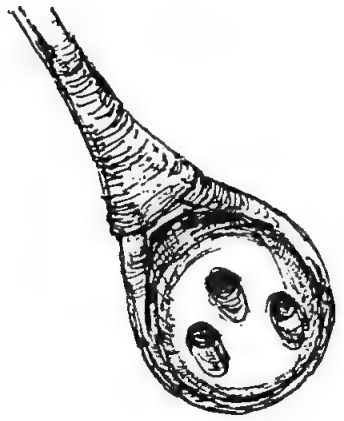


Wire is set up for serving. The serving board with its spool is rotated around the wire. Marlin or houseline from the spool is wound around the wire.

plied to the wire. This may be fish oil, tallow, linseed oil or red lead. The stay is then parcelled with strips of canvas wound around with the lay of the strand of the wire. Stockholm tar is soaked into the canvas. Marlin or spun yarn is then served against the lay, using a serving mallet or serving board, and the leverage of the mallet handle and a turn of the strand around the handle makes the serving tight. The tar is squeezed through the marlin while it is served. If the serving is to be double, another layer of canvas parcelling is added, again with the lay. The final layer is a three-strand houseline of harder lay, served with the mallet or board against the lay, and then a final coat of tar is applied. A wire thus protected will last many years if given periodic tar treatments.

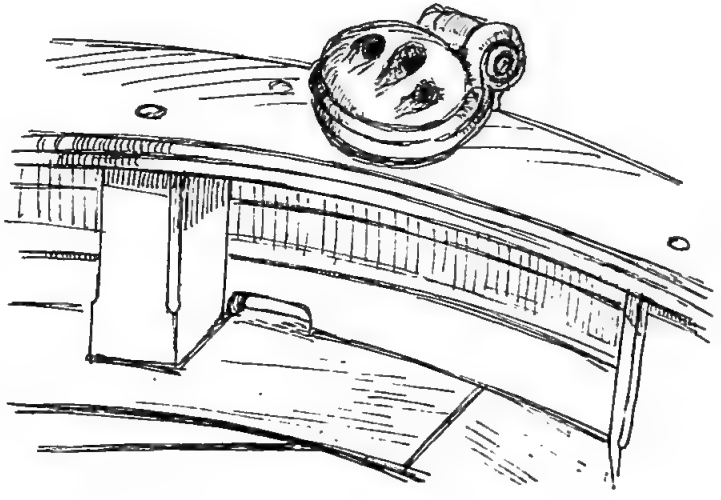
For serving a long wire, the mallet or board with a spool at the end of the handle, is faster. The wire is stretched tight before serving. By bouncing the wire, the mallet with its spool may be made to swing over the wire. It is kept swinging, over and over, and winds its way along the entire length.

The topmast shrouds run from the chain plate and deadeye aft of those for the lower



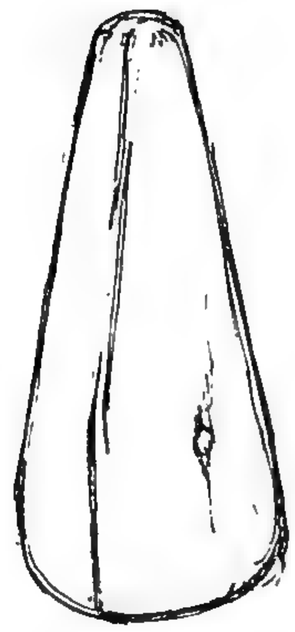
The end of a shroud with a deadeye

Deadeye on a chain plate



shrouds. At the deck there is a deadeye: the shroud then runs up and over spreaders at the lower end of the topmast and ends in an eye splice that circles the mast at the top. It is double served to prevent chafing at the eye and where it passes over the spreaders. The eyes are made large enough so the line of the stay is fair where it circles the mast at the top. The eyes are kept from slipping by cheeks fastened to opposite sides of the topmast at the masthead.

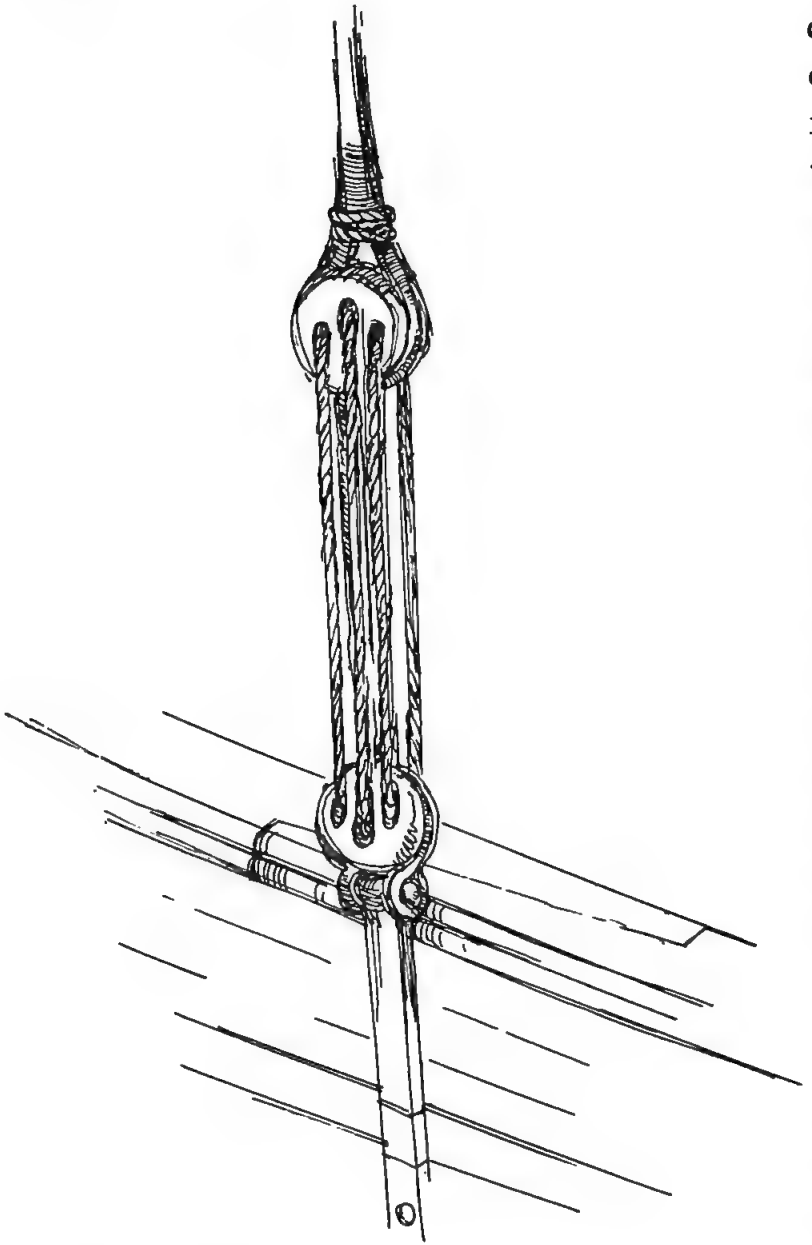
The eyes are made with a Liverpool splice. The part of the wire that will be inside the eye is first served. The wire is then bent and the bight held in a vice for splicing. The end of the line is unlaid as far as the serving. The strands are opened on the standing part with a steel marlinspike and one unlaid strand is worked through. Two other strands enter between the same strands of the standing part, but emerge one and two strands to the left, respectively, from the first. The core, a fiber permeated with lubricant, is then tucked in above the spike and the spike rotated several times, working the core into the middle of the splice. The three other strands are then tucked. The strands



A cone-shaped piece of wood three feet high for making an eye splice round. The splice is hammered down over the cone and is then removed and the eye is forced over a deadeye into the groove around the circumference.

of the standing part opposite each are opened with the spike and the strand pulled through and the spike is rotated to force the strands together. Four times each strand is tucked under the same strand of the standing part. The other two loose strands are spliced in the same manner. Similarly, the three strands which were first tucked are worked under their respective strands three more times. The splice is then finished, but for smoothing with hammering.

If the eye is to be around a deadeye, as the shrouds are at the lower end, the eye is

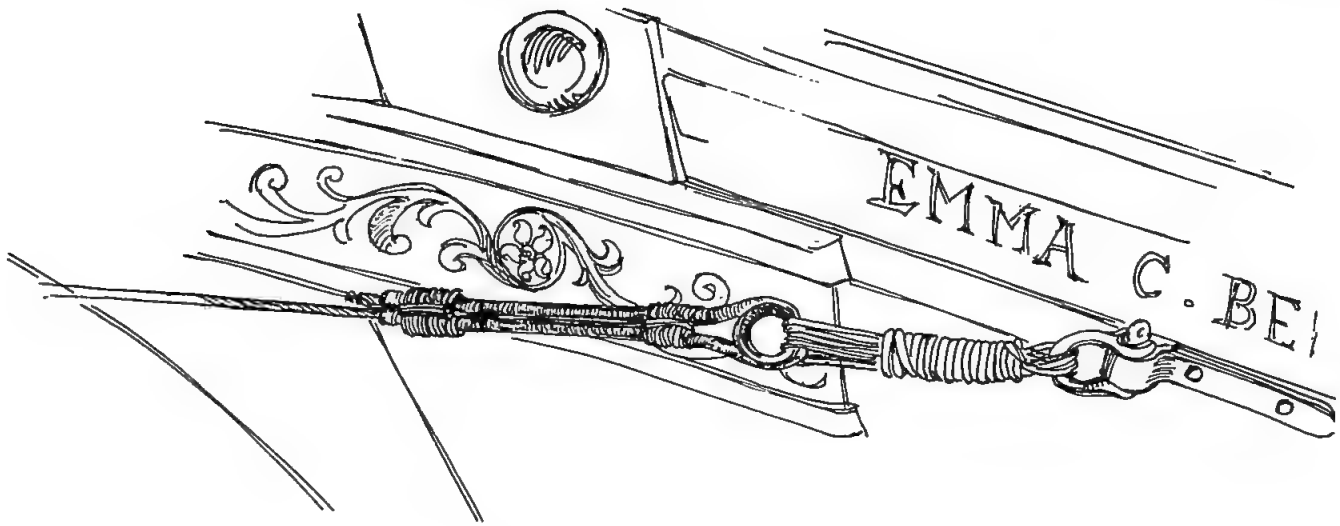


Shroud deadeyes

driven down over a large wooden cone, a commander, after it is spliced. This makes it round. It is then forced into the groove in the deadeye's circumference and is held tight by seizing.

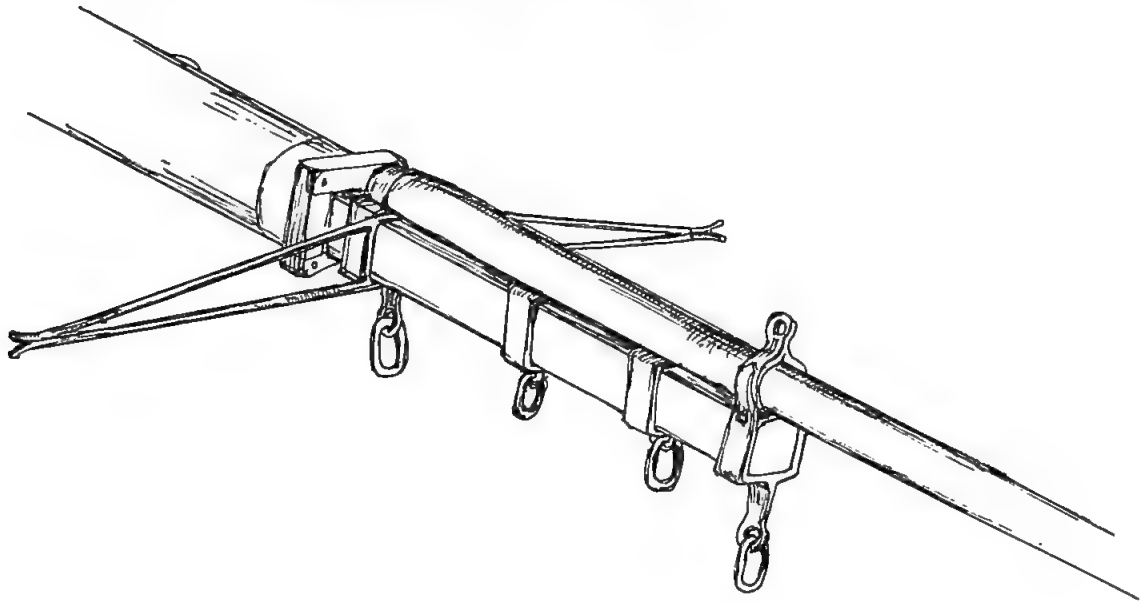
The forestay of 5/8" wire is 72' 6" long. It is served only at the eye where it circles the mast and at the tail, where it passes through a bee hole at the end of the bowsprit and down to the stem. It is secured there by being seized back on itself around a thimble. The outer bobstay, from the stem to the end of the bowsprit, is chain. It is tightened with a turnbuckle at the end of the bowsprit. The topmast headstay terminates at an eye at the end of the bowsprit and is seized back on itself. This stay is 3/8" wire and has a length of 71' 6". The bowsprit is stayed on either side by wire shrouds secured by lanyards.

The spreaders for the topmast are two horizontal iron rods welded together at the ends. The after rod is straight; the foreward one, which is on the foreward side of the mast, bends back on each side to join the other at the ends. Struts welded between the two make a collar. The distance between the



Bowsprit shrouds secured by lanyards

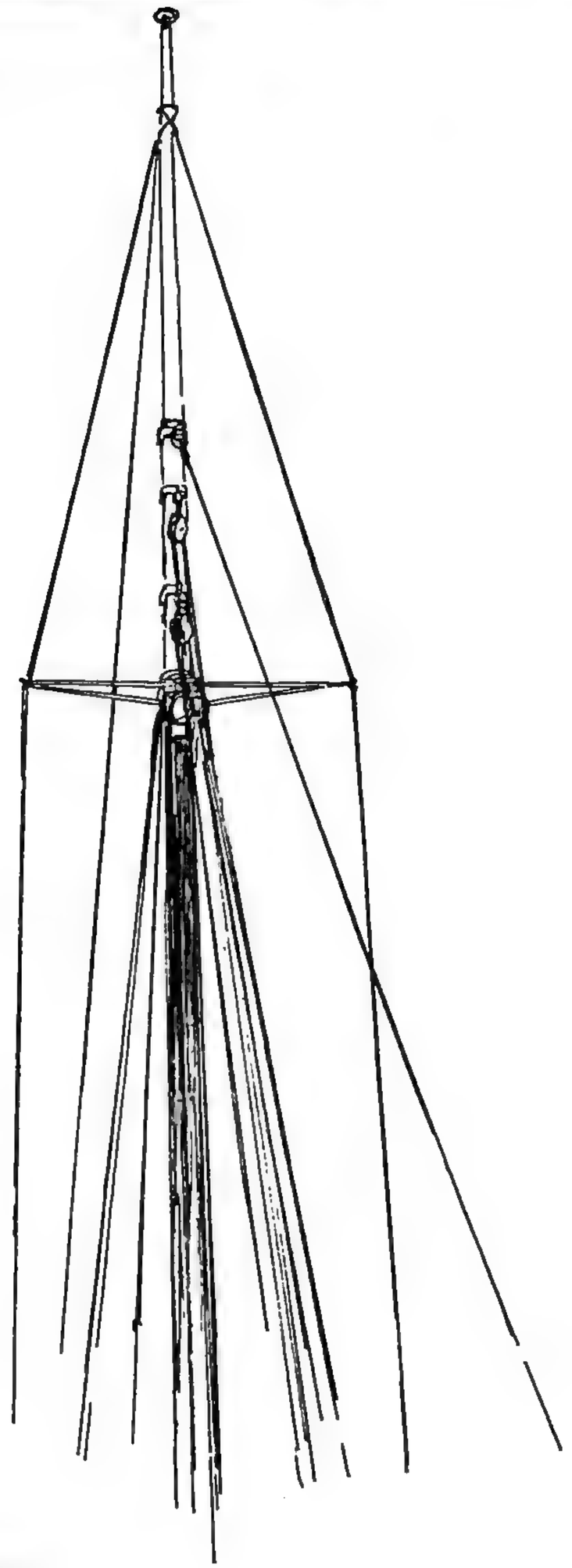
Topmast and spreaders before stopping. Topmast may be unstepped or housed by lifting out of the heel band. Topmast slides through the ring on the cap.



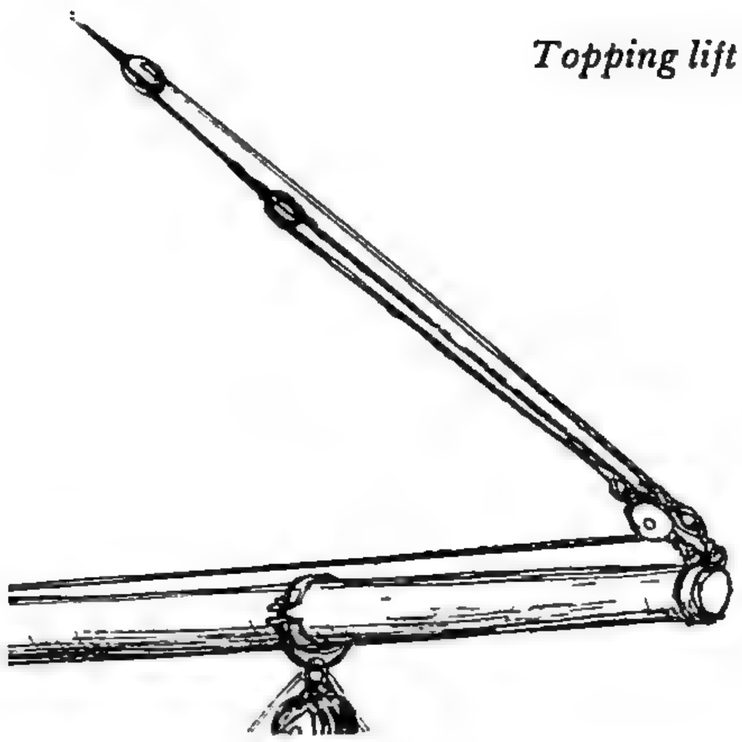
ends of the spreaders is 6′ 6″. The topmast stays tend slightly aft from the masthead, over the spreaders, and down to the deck, thus staying the topmast from behind.

The running rigging is used in hoisting the sails and tending them. The jib and jib topsail each has its halyard and sheet or sheets. The jib sheet goes to a block on a wooden sheet horse that crosses the deck between the bulwarks. A belaying cleat for the sheet is on the mast. Belaying pins are on a rail beneath the saddle on the mast. These are for the jib halyard, jib topsail halyard, main throat and peak halyards, and the gaff topsail halyard. The main sheet goes to a block on an iron sheet horse on the inside of the transom. Cavil pins for the main sheet are on bitts to either side of the wheel. The main boom is provided with a topping lift.

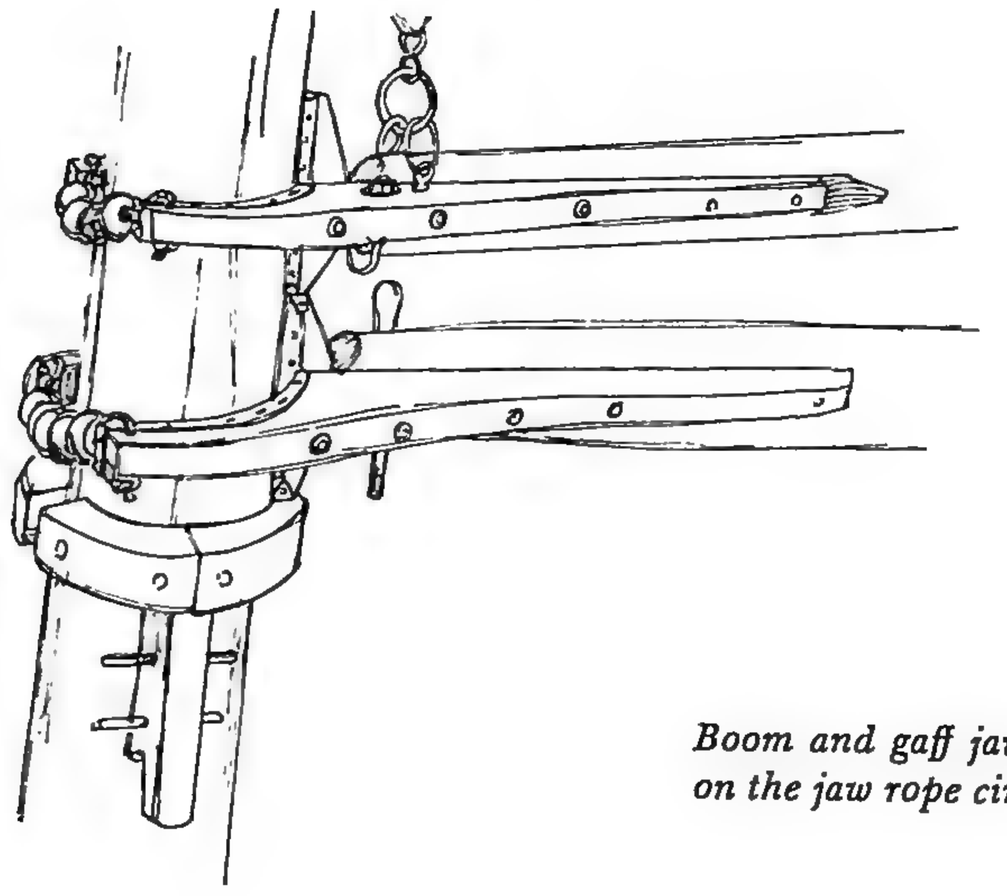
Four sets of blocks are at the top of the mast for the mainsail. These are secured to eyes on iron bands that circle the mast on the doubling: one is for the throat halyard, the others for the peak halyard. The gaff has one block at the jaws for the throat halyard and two for the peak.



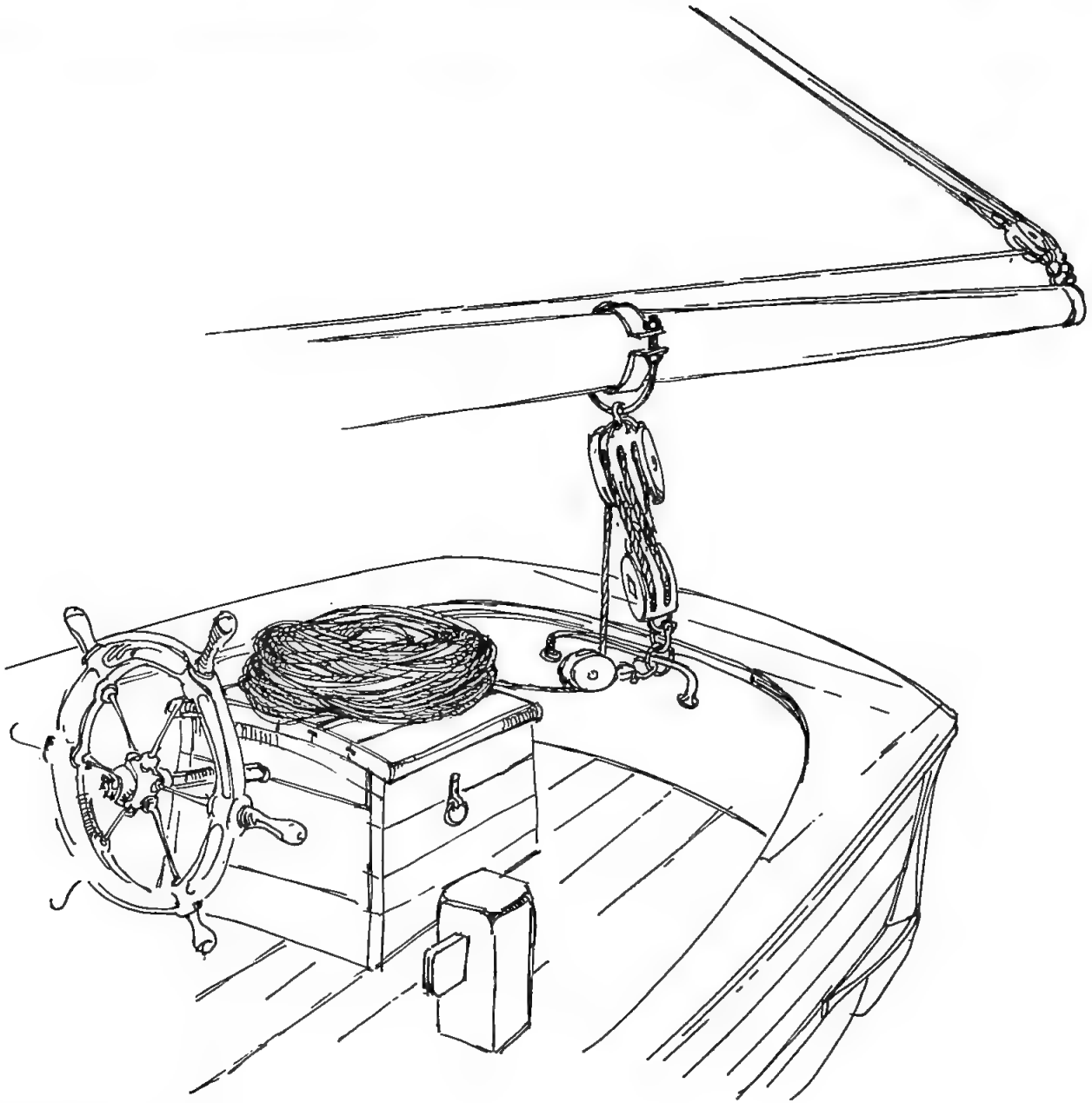
Topmast and spreaders



Topping lift for supporting the boom



Boom and gaff jaws resting on the saddle. Parrel trucks on the jaw rope circle the mast.



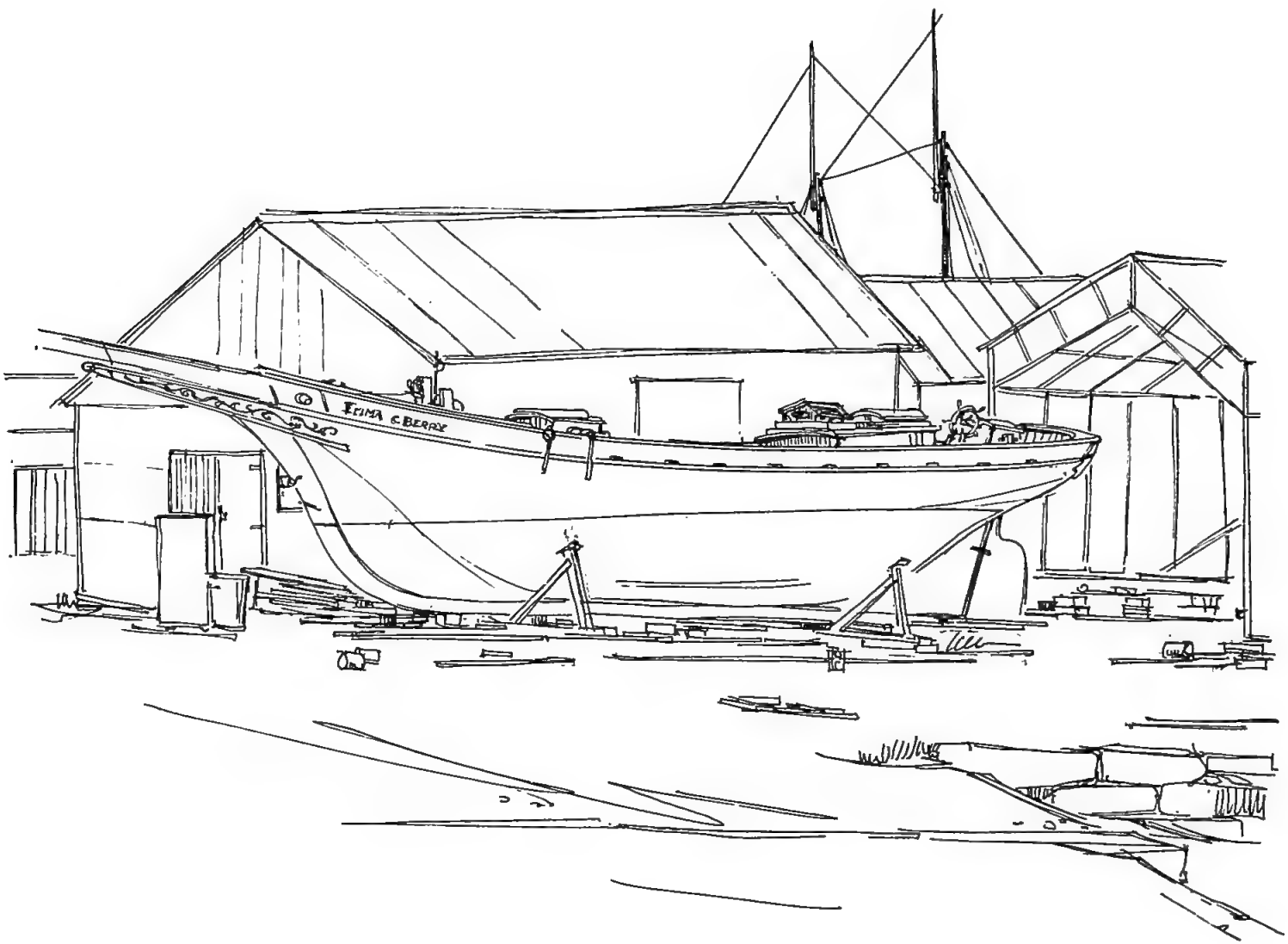
Main sheet blocks and traveler

Chapter XII

LAUNCHING AND COMPLETION

THE *Berry* was relaunched on 7 May 1971. The major portion of the work of restoration had been done by that time: there remained the completion of the wet well, the ceiling, and the building of bulkheads inside. In addition the deck in the waist—where alterations had been necessary for the opening to the well and the deck had been ripped up—had to be laid. The *Berry* was not ballasted nor was the mast stepped at her launching.

In preparation for launching, the temporary shed was partly dismantled and the rest moved to one side. The *Berry* was then taken to the marine railway. Rails were first laid across to the railway and leveled with blocking beneath, the rails held in position with stakes. The cradles under the bow and stern were jacked up and rollers placed underneath between them and the rails. A bridle of wire connected the two cradles, to the middle of which a block was shackled for the hauling line. A forklift on the opposite side of the railway provided the power. A line ran from the frame of the lift, through the block on the bridle, back to a second block on the frame of the lift, and up to the



Berry *with shed removed before launching*

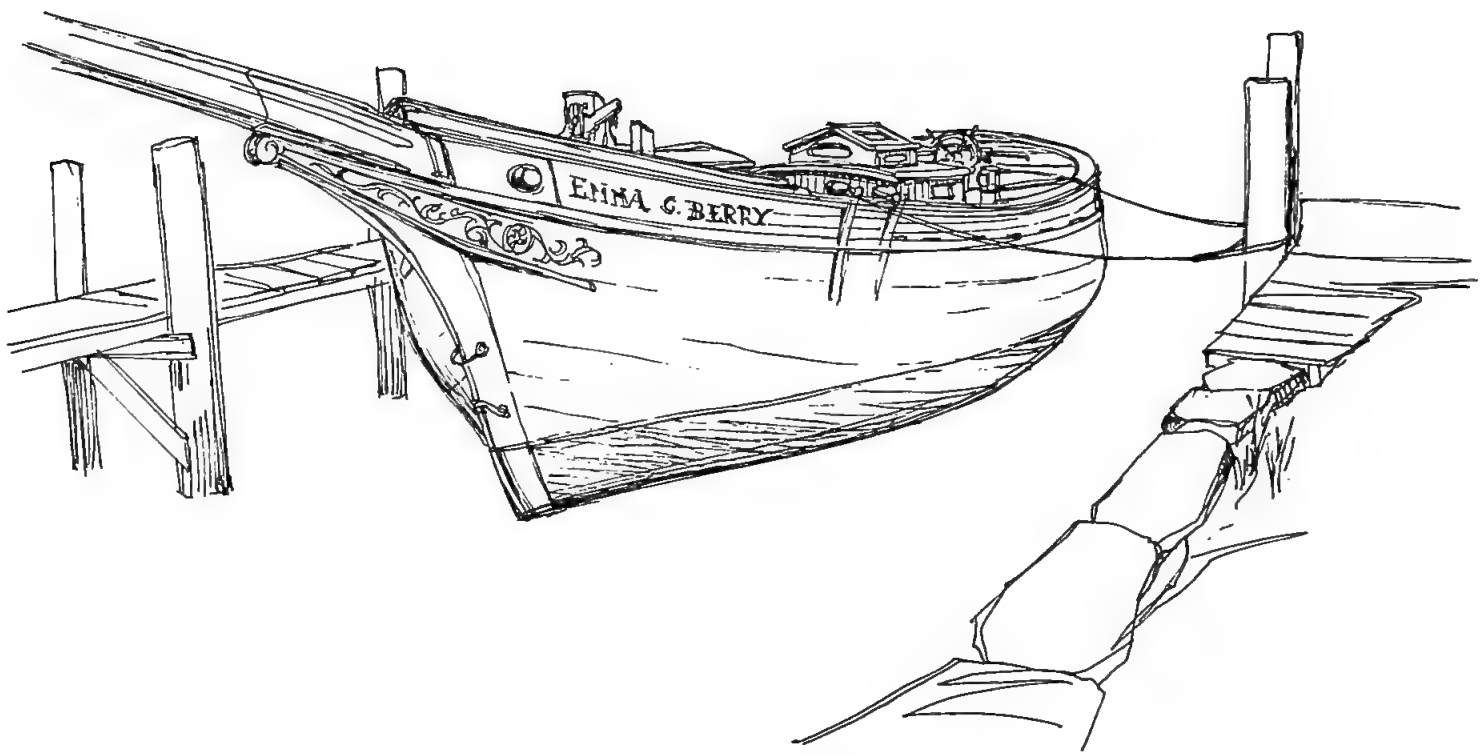
forks. The wheels of the forklift were blocked. With each lift of the forks, the *Berry* rolled toward the railway. Once on it, the shores were replaced with poppets, and lines to pull the poppets free were rigged; mooring lines were thrown over the bitts. She was then wetted down inside to soak up, and the following day at high tide, the vessel was ready.

The *Berry* was returned to the Mystic River with ceremony. Dressed with flags from a small mast stepped for the purpose, she also flew a large pennant with her name at the peak. The national colors flew at the stern. There were speeches, benediction, beer and chowder. As the railway lowered her into the water, a starting gun thundered from a boat out on the river and the steam whistle of a pile driver shrieked.

Without ballast, the *Berry* floated high. The precautions of bags of sawdust on hand and a submersible pump in the bilges ready for immediate use proved unnecessary. She was quite tight and leaked very little. Next morning the water was barely to the top of the keelson at the deepest point in the hull.

Completion of the well and ballasting were the first order of work below. The well's bedlog and the vertical tier of foundation timbers at the ends were in place before her launching. This was the most difficult part of the construction. The end bulkheads, sloping inwards, were now built up of pine timbers drifted together with ½" wrought iron galvanized drifts. The drifts were 7" long, half in each timber. The sides were completed in the same manner. The well was then caulked and painted out inside with three coats of anti-fouling paint. It was now tight and could be bored to admit water. The planking on deck around the opening to the well was then laid. The smaller access hatch aft of the well opening was built with coaming and cover. The deck planking was cedar and the seams were caulked and pitched as was the deck elsewhere.

The *Berry* was ballasted before the mast was stepped and the lead that came out of her, ingots in three sizes weighing 3,300 pounds, was replaced. The old iron ballast of scrap and elevator weights was not used. Additional lead weighing 12,250 pounds brought the total ballast to 7¼ tons. This weight was placed fore and aft of the well be-



In the slip after launching. Berry *is not yet ballasted. Work below on well, ceiling and bulkheads continues.*

tween the frames and on top of the floor timbers. Battens under the lead were not used in order to keep the weight low. The new lead was of a shape that permitted the weight of each casting to be distributed across several planks, providing the same effect that would have been gained through the use of battens. The old lead and several large pieces from a keel cut in chunks were placed on the floor timbers.

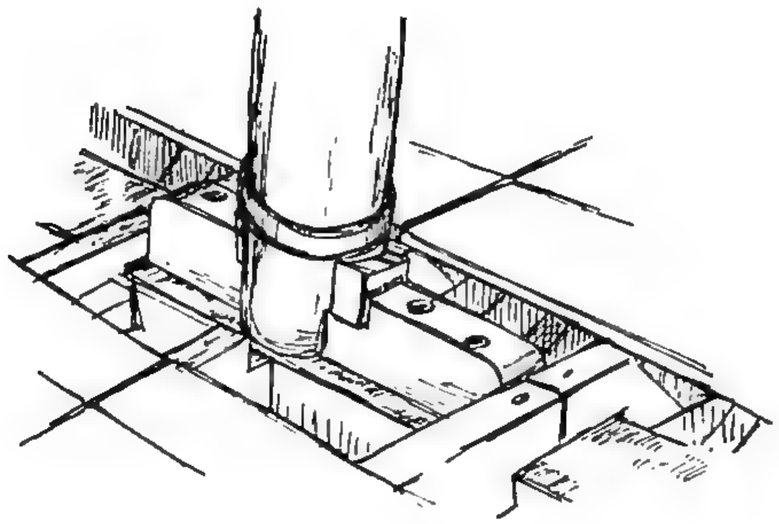
The lead ballast lowered the waterline about one foot. It was estimated that the well when flooded would add the equivalent of three tons of ballast and the spars and rigging would weigh an additional ton. Together, these were expected to increase her draft by approximately six inches.

The masts were stepped by a steam crane that was working on the river below the highway bridge. The *Berry* was towed down by the *Two Brothers,* the power boat that had accompanied her from New Jersey. The mast was wedged at the partners and the step while the crane held it in place.

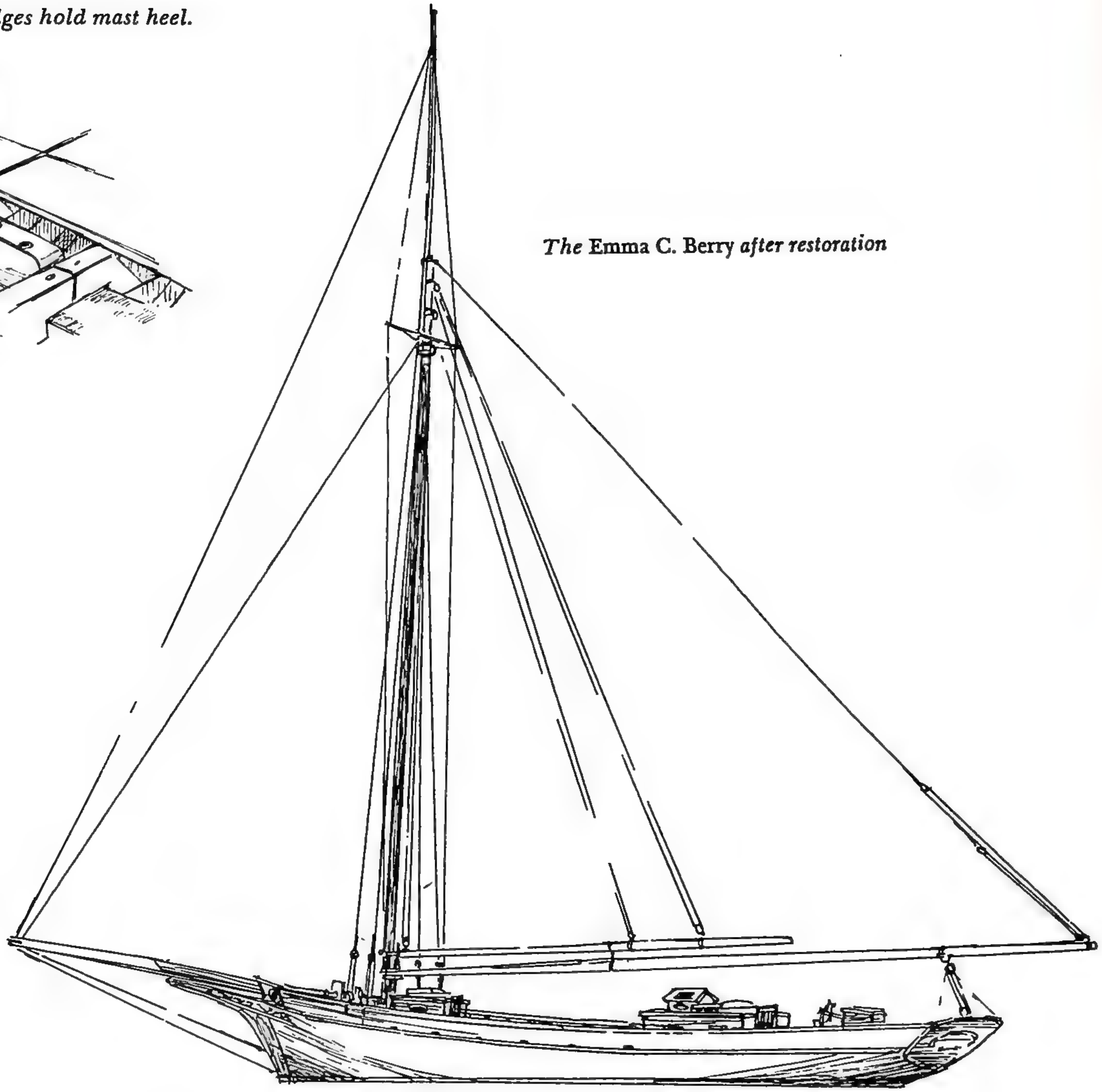
The lower shrouds and headstay were on the mast when it was stepped. These were set up and staying the mast the day after it was stepped. The shrouds were rendered around the mast to even the distances between the deadeyes and the chain plates and then were seized together below the bolster. The houseline seizing was about two inches in length. The lanyards between the deadeyes on the shrouds and chain plates were then rove off and set up. The forestay, ending in an eye lying on top of the spreaders at the top, was secured at the bottom. The stay passed through the bee hole at the end of the bowsprit and ran down to the stem, where it was seized back on itself. The mast was now stayed and the topmast and its stays could be rigged.

With the *Berry* in the water, ballasted and the mast stepped, the difficult problems and questions of her restoration were resolved. The work remaining, which would take several more months, was the finishing of tasks well underway.

The mast stepped. Wedges hold mast heel.



The Emma C. Berry *after restoration*



SCANTLINGS

After bitts: 5″ x 5″

Bulwark planking: 1¼″ x 3½″ scupper strake; 1″ thickness on upper two

Carlings: Sided 3¾″, molded 4¼″

Ceiling: 1″

Clamps: 2″ x 8″. Clamps are laminated of 1″ pieces

Covering boards: 2″

Deadwood: Sided 5″

Deck beams: Sided 3″, molded 4½″

Deck planking: 2″

Floor knees: Sided 5″ to 6″, molded 4½″ on the wings

Frames: Sided 5½″, formed by two lapped futtocks each sided 2¾″. Molded 4½″

Keel: Sided 5″, molded 10″

Keelson: Sided 5″, molded 6″

King plank: 2½″

Knightheads: 3¼″

Pawl post: 5″ x 8″; tapered to 2¾″ x 5″ at the heel

Planking: 1¾″

Rail cap: 5¼″ x 1½″

Stanchions: Sided 4″, molded 3″ tapering to 2¾″

Stem: Sided 5″

Stern post: Sided 5″

Wet well bedlogs: Sided 4″

Wet well bulkheads: 3″

SPAR DIMENSIONS

Mast: Length 54′ 7″. Diameter at step 10¼″; at widest point at the deck, 11½″; at the bolster, 8″

Topmast: Length 20′. Diameter at heel 4″; tapers to 3″ at truck

Boom: Length 42′. Diameter at jaws 6⅜″; at widest point at sheet band, 8″; at end, 5⅝″

Gaff: Length 23′. Diameter at jaws, 4¾″; at end, 3⅝″

Bowsprit: Length 23′ 7″; 8″ x 8″ at inboard end; round 5¼″ diameter at outboard end

RIGGING

Standing rigging: All standing rigging, but for the chain bobstay, is six-strand, galvanized, plowsteel wire

Forestay and lower shrouds: ⅝″ diameter wire

Topmast stay and shrouds: ⅜″ diameter wire

Topping lift: ⅜″ diameter wire

Bowsprit shrouds: ⅜″ diameter wire

Running rigging: All running rigging is Manila line, ¾″ diameter

GLOSSARY

BATTEN—A thin strip of wood sprung around reference points to make a fair line.

BILLETHEAD—Decorative work, often in a scroll, at the end of the cutwater under the bowsprit.

BITT—A post set vertically in the deck to support the windlass or to secure lines such as a mooring bitt.

BOLSTER—Frame of wood around the mast above the hounds. Shrouds lie on top of the bolster.

BOOM SADDLE—A rest or collar on the lower mast upon which the jaws of the boom rest.

BUTT—The seam where the ends of two planks come together.

CARLING—A short timber laid fore and aft, part of the deck frame, to each side of the hatch.

CARRIAGE BOLT—A threaded bolt with a round head. A square collar under the head prevents it from turning as it is tightened.

CAULKING SEAM—A bevel cut on the edge of planking to provide an opening for caulking.

CEILING—The inner planking laid on the frames inside a vessel.

CHAIN PLATES—Iron straps bolted to a vessel's sides with deadeyes at the top for shrouds.

CLAMPS or SHEER CLAMPS—Timbers running the length of the vessel inside where the sides meet the deck. They are fastened to the frames and the deck beams rest on them.

COVERING BOARDS—On deck the planks closest to the sides. They are sawn to shape and cover the frame tops and lie on the top edge of the sheer strake.

CROWN—The arch of the deck athwartships to allow water to run off.

DEADWOOD—Solid timbering built up from the keel inside the stem and the stern post. In the *Berry* the ends of the keelson lodge in the deadwood.

DOUBLING—The overlap of mast and topmast.

DRIFT—A rod of metal used to fasten timbers together. It may be riveted at both ends or "headed up" if it passes through both timbers. It is then called "through fastened."

FASTENINGS—Screws, ship spikes, boat nails, rivets, etc. used to attach planking, etc.

FLOOR TIMBERS or KNEES—Timbers crossing the keel that tie together the frames and the keel. They may be straight-grained or crooked.

FUTTOCKS—Short timbers or sections making up frames. They usually lap.

GARBOARD STRAKE—The strake or plank closest to the keel.

GRAVE—To cut out and plug knots and bad places in timbers to check rot.

HOUNDS—The point on the mast where it changes from round to square. The bolster rests on the shoulder formed.

KEELSON—A fore-and-aft timber that stiffens the hull. It is lodged in the deadwood at both ends and lies on top of the floors.

KING PLANK—The deck plank, sometimes thicker, on the centerline. The mast and pawl post pass through it.

KNIGHTHEADS—Stiffening timbers in bow of boat abaft the stem. They brace the bowsprit on either side.

LAG BOLT—A bolt with screw threads on one end and a square head.

MAST STEP—The timber upon which the heel of the mast rests. It may have a slot or notch cut in it to take the mast.

MOLDED—A measurement of any timber in a direction from outside to inside of a vessel, as opposed to sided. The term is from the molds or patterns which were laid on a timber for marking for cutting.

NATURAL-CROOK KNEES or FRAMES—Knees or frames cut from timber that grew with a sweep to the grain.

PARTNERS—A collar formed by deck beams and carling for the support of the mast or a bitt.

PAWL POST—A bitt with the windlass pawl. The bowsprit may mortice into the forward side.

PINE—To drive pine or softwood wedges around stanchions where they pass through the deck or covering board.

REEF—To remove old caulking from a seam.

SCARF—A joint made by cutting back the ends of timbers on an angle and lapping them. A scarf joint may be glued and bolted.

SEIZE—To bind two wires together by lashing with several turns of small stuff such as marlin.

SERVE—To wrap a wire with a layer or layers of canvas and small stuff.

SHEER STRAKE—The plank or strake closest to the deck. Its top edge is the sheer or curve of the vessel's deck.

SIDED—The width of any timber measured on the outside. See molded.

SPILE—A means of marking a plank for cutting to fit the curved edge of another plank.

STANCHION—The vertical timbers or posts along the sides that support the bulwarks.

STANDING PART OF A LINE—In knotting, the main part of the line or wire as opposed to the end or a bight.

STOPWATER—A softwood dowel driven across a seam to prevent leaking.

STRAKE—A plank or a wale.

TRAILBOARDS—Decorative boards on either side of the cutwater behind the billethead.

TREENAIL—A hardwood dowel used to fasten timbers together and planking to frames.

TRUCK—The disk of wood, often with sheaves for flag hoists, at the top of the mast.

MEN WHO WORKED ON THE RESTORATION OF THE *EMMA C. BERRY*

SHIP CARPENTERS
Arnold L. Crossman, *shipwright in charge of restoration*
Irving Holdredge
Howard Davis
Mark Thackston
Willits Ansel
NOTE: *Arnold Crossman and Irving Holdredge worked on the* Berry *for the entire restoration*

RIGGER
Robert Boulware

PAINTER
Malcolm Stewart

CAULKER
Bert LeBlanc

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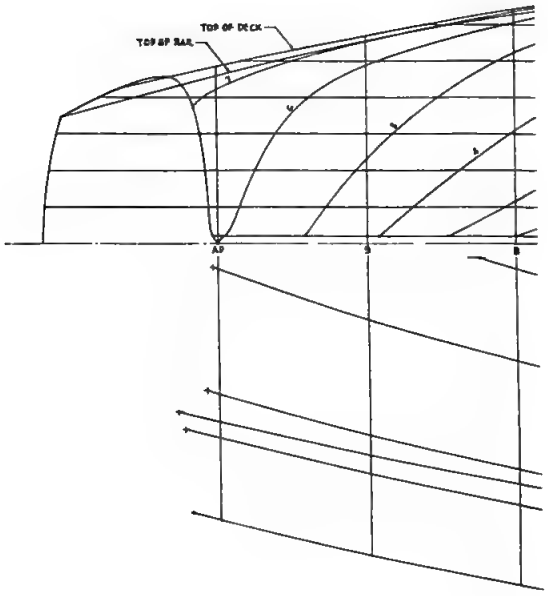
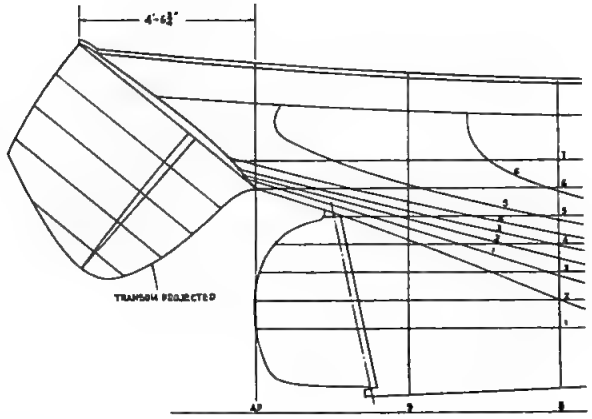


LINES LIFTED JULY 2 1969 AT WEST MYSTIC SHIPYARD BY T.W.DUNN & R.C.ALLYN. AT THAT TIME KEEL WAS HOGGED 3" FOR WHICH THESE LINES HAVE BEEN CORRECTED.



THE MARINE HISTORICAL ASSOCIATION INC.

MYSTIC SEAPORT

MYSTIC CONNECTICUT

NOANK SLOOP-EMMA C. BERRY

LINES

DRAWN BY R.C.ALLYN
TRACED BY-REPROVEL

DATE - NOV. 24. 1970
AUTHORIZED BY J.R.C.

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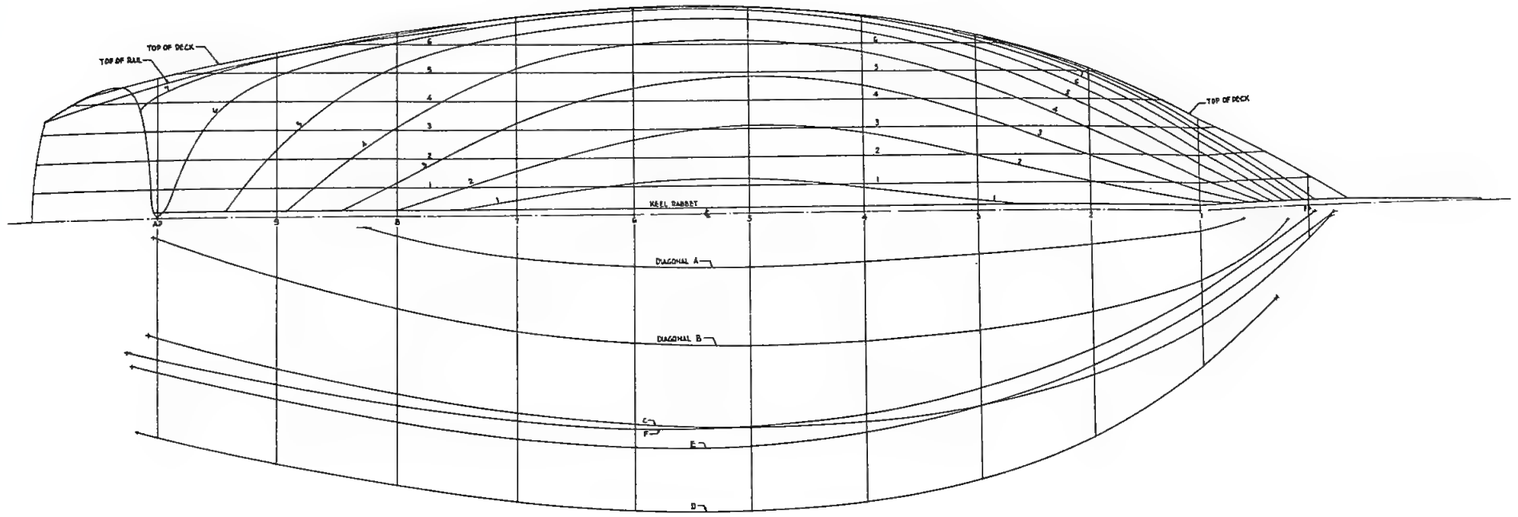

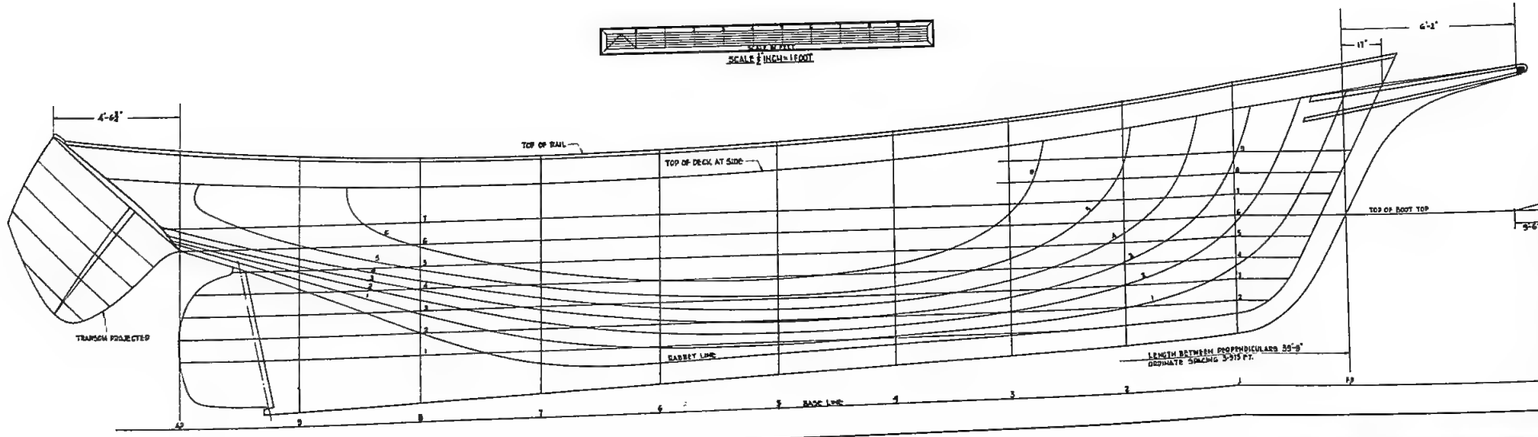

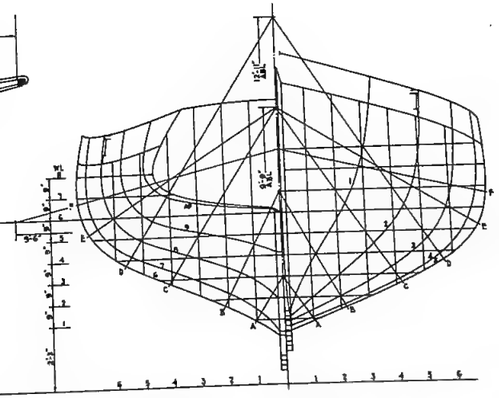

LINES LIFTED JULY 2, 1969 AT WEST MYSTIC SHIPYARD BY T.W.DUNN & R.C.ALLYN. AT THAT TIME KEEL WAS HOGGED 3" FOR WHICH THESE LINES HAVE BEEN CORRECTED.

THE MARINE HISTORICAL ASSOCIATION INC.
MYSTIC SEAPORT
MYSTIC CONNECTICUT

NOANK SLOOP-EMMA C. BERRY

LINES

DRAWN BY R.C.ALLYN
TRACED BY-REPROVEL
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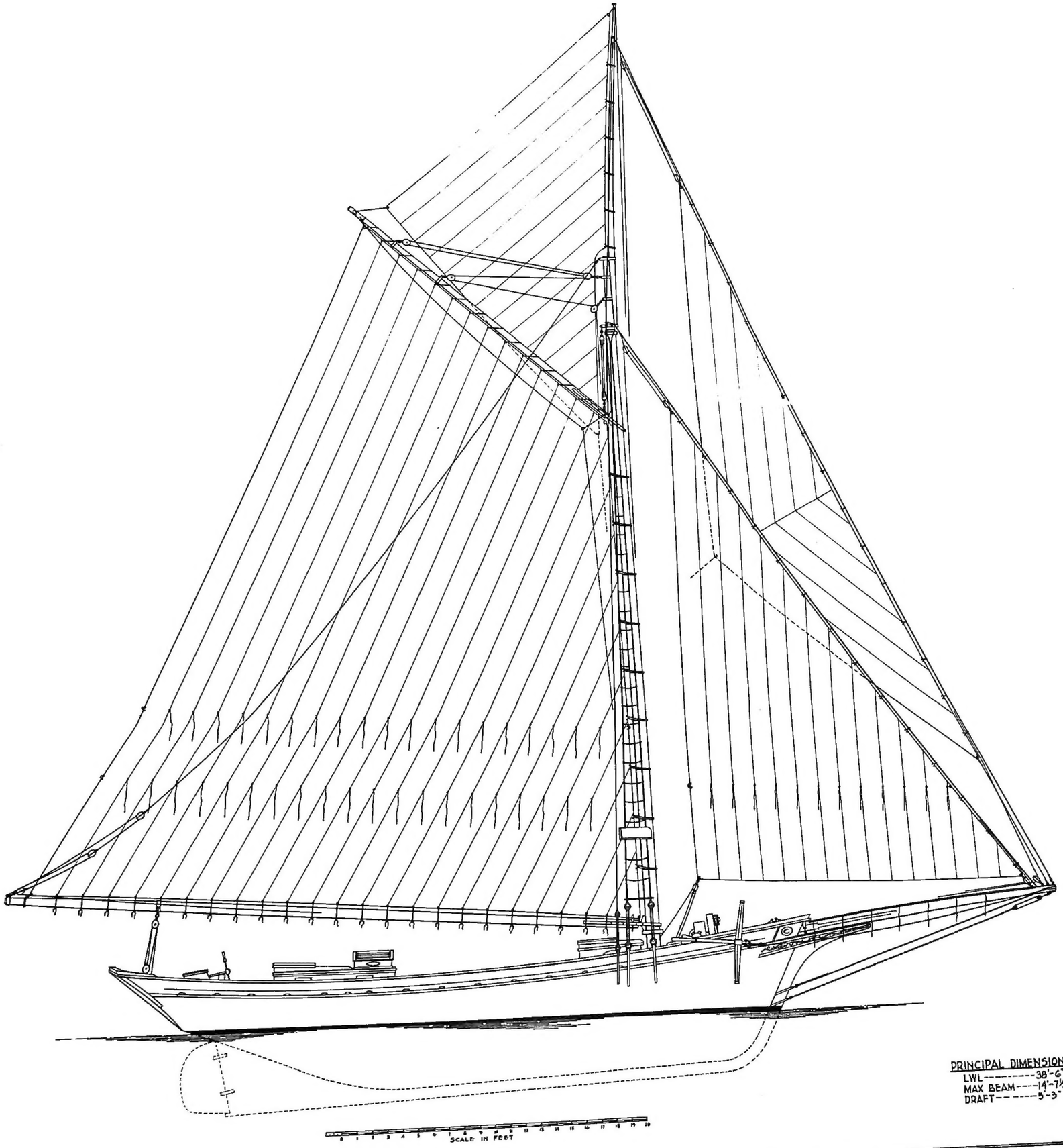

PRINCIPAL DIMENSIONS
LWL---------38'-6"
MAX BEAM----14'-7½"
DRAFT-------5'-3"

THE MARINE HISTORICAL ASSOCIATION INC.
MYSTIC SEAPORT
MYSTIC CONNECTICUT

NOANK WELL-SMACK EMMA C. BERRY

PROFILE & SAIL PLAN

DRAWN BY R.C. ALLYN
TRACED BY R.C. ALLYN
DATE - JAN. 18. 1972
AUTHORIZED BY J. Russell Penn

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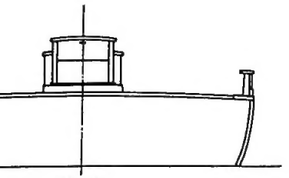
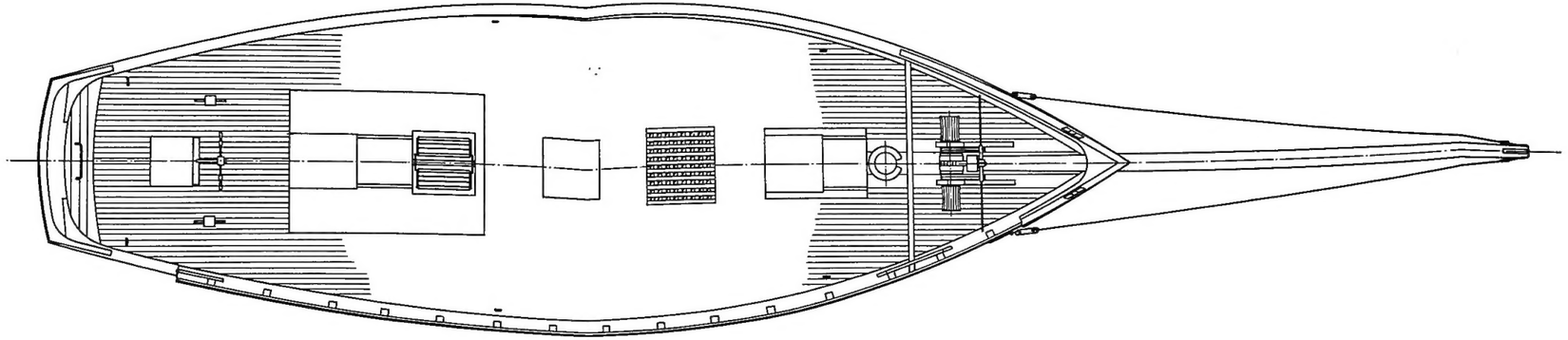
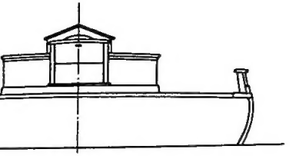


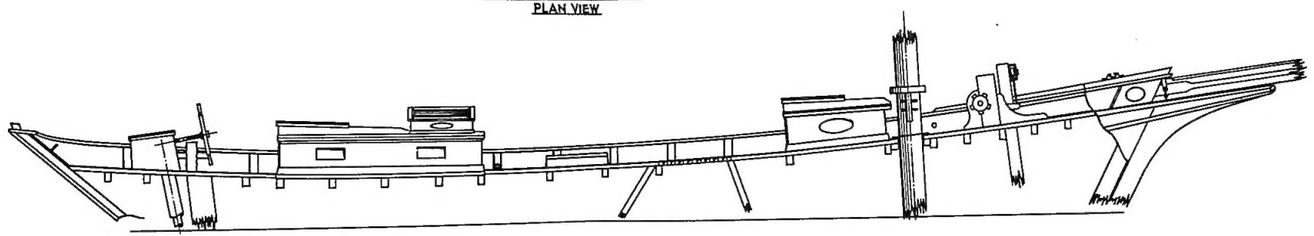
HATCH
LOOKING FWD



DECK ARRANGEMENT
PLAN VIEW



DECK HOUSE
LOOKING FWD



℄ ELEVATION

SCALE IN FEET

THE MARINE HISTORICAL ASSOCIATION INC.
MYSTIC SEAPORT
MYSTIC CONNECTICUT
NOANK WELL-SMACK EMMA C. BERRY
DECK PLAN

DRAWN BY R.C.ALLYN
TRACED BY R.C.ALLYN

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